The Refrigeration Service Engineer

Vol. 7
No. 7

JULY • 1939

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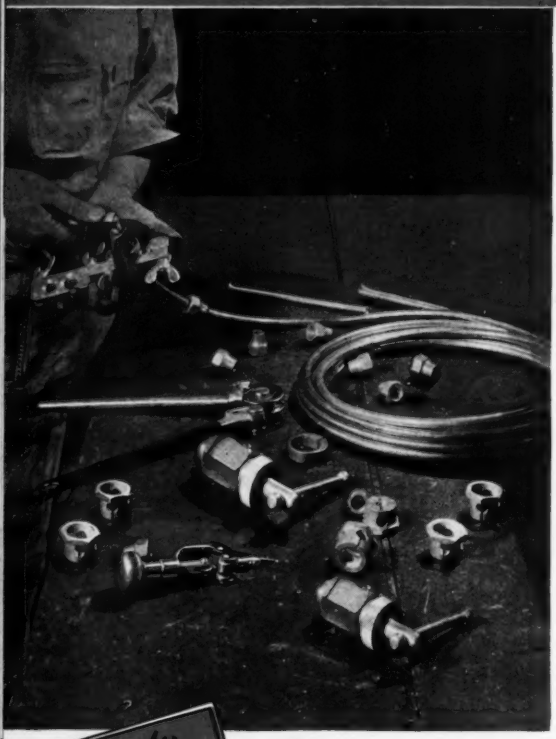

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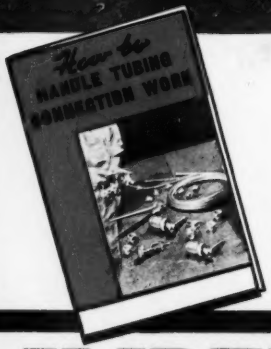

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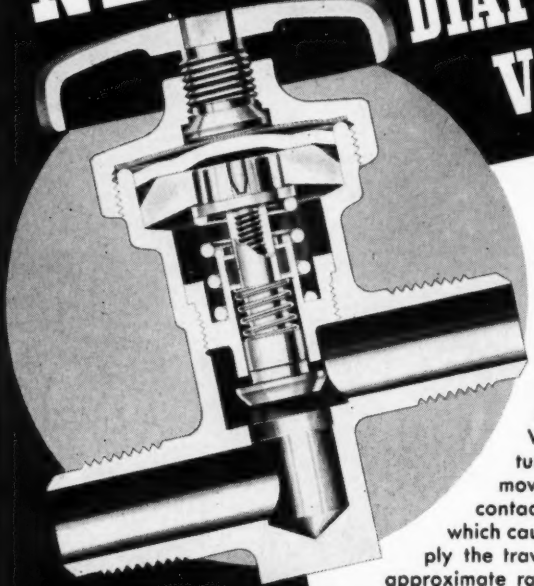

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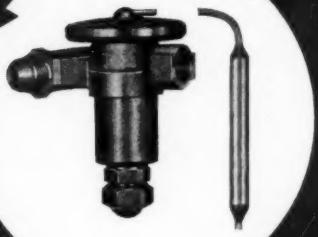

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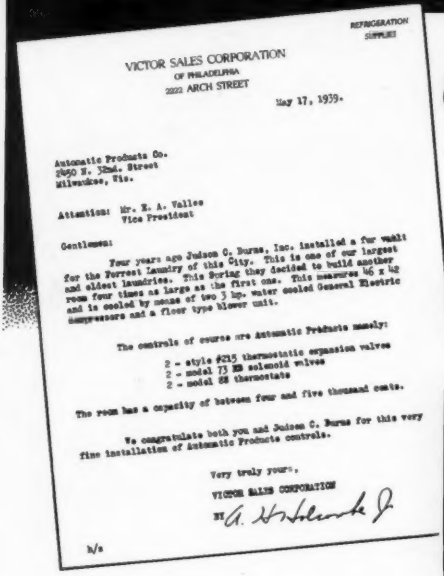

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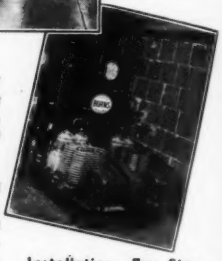

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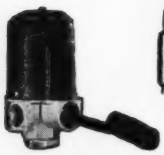

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The Refrigeration Service Engineer

Vol. 7 No. 7

July 1939

A Monthly Illustrated Journal Devoted to the Interests of the Refrigeration Service Engineer in the Servicing of Domestic and Small Commercial Refrigeration Systems and Oil Burners

Official Organ
REFRIGERATION SERVICE ENGINEERS SOCIETY

Front Cover

A typical scene during one of the many tube bending contests held in various cities throughout the country recently. The contest shown was part of the activities of the Los Angeles Chapter R.S.E.S., and as usual the materials, instructions, project plans, etc., were furnished by the Imperial Brass Mfg. Co. of Chicago.

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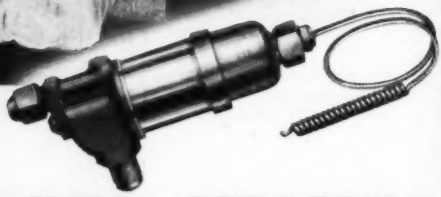
One corner of the charging room where Detroit Thermostatic Expansion Valves are gas charged.



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The Refrigeration Service Engineer

VOL. 7, No. 7 CHICAGO, JULY, 1939 $2.00 per Annum

Defrosting Low Temperature Commercial Evaporators

By EDWARD N. AVERY

E. N. AVERY

WHEN mechanical refrigeration is employed to maintain refrigerated spaces at temperatures below 32 degrees the defrosting of the evaporators used in such installations becomes a rather difficult problem. Since the temperature of the surrounding air never rises above the freezing point of water, a defrosting cycle is out of the question and some other means of removing the accumulated frost must be employed.

With the coming of the modern refrigerated locker plant and frozen food plant, low temperature installations are multiplying rapidly. Since the success of the entire installation depends on the user's ability to remove the accumulated frost easily and quickly, it is necessary that the installation engineer become familiar with the best methods of defrosting as applied to such units.

Since no one method is the best to use in every instance, the writer will cover each method, giving the good and bad points of each.

Defrosting by Scraping

In the past, coil manufacturers have recommended that bare pipe coils, or coils with wide fin spacing be employed,—fin spacing of from one inch to two inch being common.

The first cost of such coils is necessarily higher than that of an ordinary coil of like capacity, since they must be made larger in order to provide the same amount of surface. The larger coil often makes it necessary to use valuable storage space in order to provide room for the coil.

The use of such coils make frequent defrosting unnecessary and the frost is usually allowed to build up to large proportions since the user "puts off the necessary evil" as long as possible. When defrosting finally becomes necessary, in order to maintain temperatures or restore lost efficiency, it is usually accomplished by taking advantage of the light feathery nature of such frost and scraping it off by hand.

Where scraping is resorted to, the stored product must often be moved to some other position in the box, and considerable time spent in removing the accumulated frost. Considerable labor is therefore necessary and since the evaporator may be damaged if the scraping is not carefully done, the work must be done by skilled workmen.

This method is widely used for the defrosting of brine tanks as no loss of refrigeration takes place.

Natural Defrosting

When bare coils are mounted in inaccessible positions, the most common method of defrosting them is to remove the stored product to some other refrigerated space and then throw all doors open and allow warm air to circulate either naturally or with the aid of fans until the frost has melted off.

When the ice bunker is so constructed as to allow the blocking of all air circulating passages, the same result may be obtained without the necessity of removing the stored product. After closing suitable doors which will stop the air circulation, the ice bunker door may be opened and the frost allowed to melt.

Through the use of this last method the loss of refrigeration is not as great and the amount of labor required is much less.

Both of these methods leave much to be desired, however, and it is recommended that other methods be used whenever possible. The chief objections to the above methods are the slow rate at which defrosting takes place, the large amount of labor involved and the large loss in refrigeration.

When the ambient temperature is low the defrosting period may be prolonged to such an extent that the stored product will warm up beyond the desired point and will suffer as a result.

Brine Spray Defrosting

The use of brine spray equipment is of definite value in defrosting low temperature evaporators.

The spray equipment is usually operated continuously or at least whenever the condensing unit is operating. This maintains the evaporator in a frost-free condition, and since the heat transfer surfaces are always moist, heat transfer is accelerated to a large extent. The brine quickly assumes the temperature of the evaporator and since considerable surface is presented by the countless number of minute droplets of brine, heat transfer is also aided materially from this source.

This method of defrosting is finding favor with the manufacturers of blower type, low temperature evaporators. However, since a rapid movement of air is maintained through the unit at all times, a good job must be done from an engineering angle lest minute particles of the salt used in the brine be introduced into the refrigerated space with consequent contamination of the stored product.

Brine Will Corrode Parts

The brine has a tendency to corrode the various parts of the low side equipment, and here again a good engineering job must be done in order to keep this at a minimum.

The brine is constantly being diluted by the frost removed, by the moisture condensed on the surface of the evaporator and by the moisture condensed on the surface of the drops of brine. Additional salt must be added at intervals in order to maintain the brine at the desired strength, or some means of regenerating the brine must be employed.

The use of brine spray is not confined to the defrosting of blower type units by any means. It may be applied to brine tanks, flooded type evaporators or other similar equipment with equal success. The main advantage in using brine spray in such instances lies in the fact that no loss of refrigeration takes place.

The brine may be stored in the refrigerated space and the equipment operated only at intervals, whenever it becomes necessary to defrost the evaporator. Since the temperature of the brine will only be a few degrees above that of the evaporator, no material change in evaporator temperature will take place while defrosting is in progress.

Even the few heat units given up to the evaporator by the brine do not represent a loss as the brine will assume a lower temperature and will in turn absorb heat units from the air after being returned to the storage tank, a net gain in efficiency rather than a loss is a result.

It must be borne in mind that the defrosting does not depend on the brine being warm enough to melt the frost. Defrosting will take place even though the brine is below the freezing point of water.

The action depends on the brine lowering the freezing point of the frost (which must be considered as just so much ice) to a point below the evaporator temperature. The frost then melts and absorbs heat units from the

evaporator and the brine. Thus we can see that there is no loss of refrigeration from this angle.

The only loss is that introduced into the refrigerated space by the heat developed in the motor-driven pump and this loss is so small that it is more than compensated for by the increased efficiency in the evaporator.

Defrosting with Electric Heat

The manufacturers of blower type units have also met the defrosting problem by equipping their low temperature evaporators with insulated shells and louvers and providing an electric heating element which warms the confined air to a point at which the frost will melt off.

All that is necessary to defrost, is to close the louvers, close the suction line valve mounted on the unit, turn off the blower and turn on the electric heat.

Since the suction line valve is shunted by a pressure relief valve, there is no danger of excessive pressure building up in the evaporator being defrosted. It is not necessary to shut down the condensing unit, and if there are more evaporators on the same condensing unit, they may be allowed to operate in a normal manner, and thus refrigeration may be maintained.

When the unit is completely defrosted, all that is necessary to restore normal operation, is to operate the various controls in the reverse order. Gradual opening of the suction line valve is recommended, however, since the pressure in the evaporator will be much higher than that found during normal operation.

Defrosting blower type units in this manner usually takes from 20 to 30 minutes. This method leaves little to be desired so far as labor, time, or loss of refrigeration are concerned. While there will be a small loss of refrigeration due to the heat introduced by the electric heat, the advantages, such as ease of installation and maintenance, more than offset the loss.

Hot Gas Defrosting

Where dry type evaporators are used, hot gas defrosting, properly applied, offers a satisfactory method of removing the accumulated frost. The circuits given in Figs. 1 and 2 are typical of those usually employed. In using either of these circuits the liquid line valve should be closed and the evaporator pumped out so that there will be no entrapped liquid present to interfere with the hot gas reaching all parts of the coil.

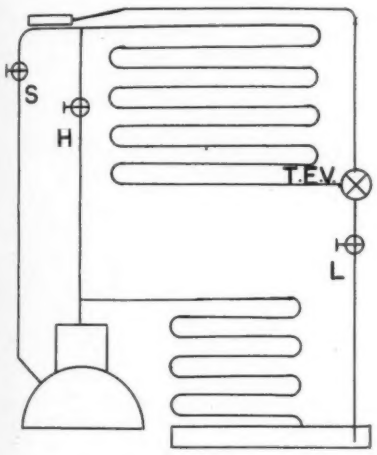


FIGURE 1.

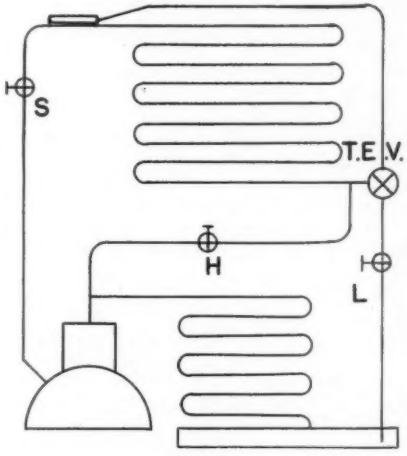


FIGURE 2.

After the evaporator has been pumped out and the condensing unit stopped down by the pressure switch, the suction line valve should be closed and the hot gas from the condenser may then be admitted to the coil by opening the hot-gas valve.

Defrosting takes place at a rate depending on the size of the evaporator, the amount of the accumulated frost, the amount of hot gas contained in the condenser and on the temperature of the liquid in the liquid re-

ceiver. Some portion of the refrigerant in the liquid receiver usually has to evaporate in order to supply sufficient gas to completely defrost the coil.

Both of these methods should be used only with bottom feed coils. Considerable liquid will condense in the evaporator and liquid slugs would return to the compressor via the suction line when the condensing unit was again placed in operation, if these circuits were to be used with top feed coils.

Since in using the connections given in Fig. 2, all the hot gas passes up through the condensate and warms it, somewhat better action is obtained than when using the method outlined in Fig. 1.

A hot gas line equal in size to that of the liquid line used, is sufficient to properly defrost the average evaporator. Where exceptionally large coils are used the hot gas line should be increased one size.

Restoring Normal Operation

When defrosting is complete and we are ready to place the evaporator back in normal operation, the hot gas valve should be closed and the suction line valve should be just cracked off its seat. This is done because almost full head pressure is present in the coil and if care is not taken it will be applied to the seal which may blow under these conditions.

There is also a danger of liquid slugs returning to the compressor, since the entire coil may be full of condensed refrigerant.

After the condensing unit has operated a short period of time, the suction line valve may be opened a slight amount, and after refrigeration is well under way the valve may be returned to the full open position. The liquid line valve may now be opened and normal refrigeration is resumed.

Since the defrosting operation will be taken care of by the customer, all valves used in the operation should be of the packless, handwheel type, and should be securely mounted in an easily accessible position. All valves should be plainly numbered or otherwise identified so that there will be no possibility of manipulating the wrong valve. A chart should also be placed in such a position that it cannot be easily overlooked, giving the proper order of operation for the valves and other essential information.

The use of hot gas, for defrosting, as outlined, has several disadvantages. Both the above methods are somewhat slow and the compressor may be damaged if an error is made in operating the valves and they can only be used with bottom feed coils. Little labor is required however, and the coil is left in an entirely frost free condition.

Regenerative Hot Gas Defrosting

In installations where there are two or more dry-type evaporators on the same condensing unit, the methods outlined in Figs. 3 and 4 may be used with excellent results. By their use most of the bad features of the previously described hot gas defrosting methods are eliminated.

While the writer makes no claim as to the novelty of the circuits given in Figs. 3 and 4 since somewhat similar circuits have been employed in ammonia practice for years, still the writer has never seen check valves employed as at C and C in these diagrams. The use of check valves makes it unnecessary to employ packless valves at these points, and since this is a location at which frost would accumulate, the operating parts of packless valves could be expected to freeze up and make the whole defrosting system inoperative.

As will be noted from Figs. 3 and 4, this method may be applied to both top and bottom feed coils.

To use these circuits, the common liquid line valve should be closed, the proper suction line valve should be closed and the corresponding hot gas line valve opened. It is not necessary, nor desirable, to pump out the evaporator to be defrosted.

Defrosting begins immediately, the hot gas condensing in the evaporator and giving up its latent heat of vaporization, causes the frost to melt rapidly. All condensed refrigerant flows by gravity to the lowest point in the coil and passing through the check valve, due to the difference in pressure, travels via the liquid line to the T. E. V. on the other evaporator and supplies liquid to maintain refrigeration at this point.

The condensing unit will usually cycle several times while defrosting is in progress, due to the fact that some of the hot gas will condense in the condenser and the operating evaporator will starve for liquid until the machine cycles and the hot gas has a chance to catch up.

Complete defrosting, however, is usually accomplished in from 5 to 15 minutes, depending on the size of the evaporator and on the amount of the accumulated frost.

When the coil is completely defrosted, the hot gas valve should be closed and the condensing unit should be allowed to operate until stopped down by the pressure switch.

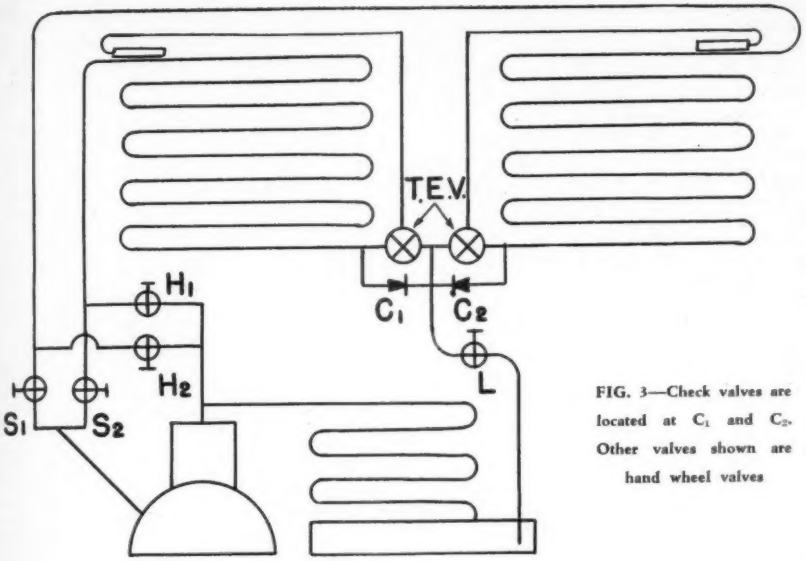


FIG. 3—Check valves are located at C_1 and C_2. Other valves shown are hand wheel valves

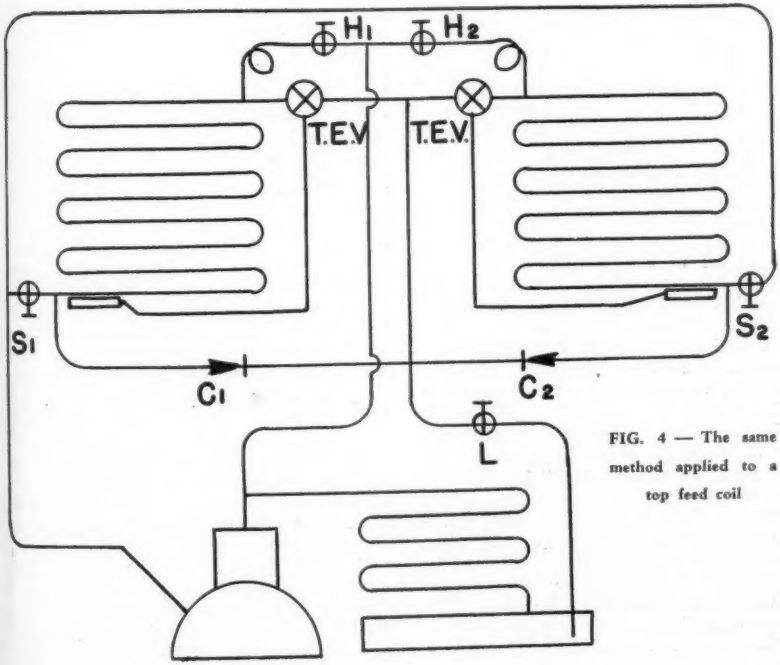


FIG. 4 — The same method applied to a top feed coil

Both evaporators are now in a pumped out condition and under normal back pressure. The suction line valve may now be opened with no danger of applying excessive pressure to the seal and with no danger of liquid slugs returning to the compressor.

Before beginning the defrosting of the other evaporator or evaporators, the common liquid line valve should be opened and the unit allowed to operate in a normal manner for a period of from 5 to 15 minutes. This will insure a sufficient supply of liquid in the evaporators, which will prevent short cycling when the defrosting of the other evaporator is begun.

These circuits fulfill all requirements so well, it is unfortunate that they can only be used where there are two or more evaporators on the same condensing unit. However

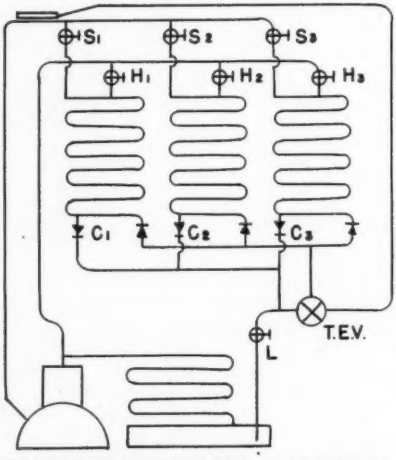


FIG. 5—HOT GAS DEFROSTING AS APPLIED TO MULTIPLE COILS ON ONE VALVE

where we have one evaporator made up of two or more sections the method given in Fig. 5 may be applied. If the evaporator is made up of horizontal sections, the uppermost section should be defrosted first and the defrosting should be applied progressively downward. The reason for this is, of course, self evident, to prevent icing up the coil just defrosted. Vertical coils present no different problem from ordinary coils. The hot gas defrosting methods just described, like those previously described, require no labor. All that is necessary is to manipulate the various valves in their proper order, and unlike the previous methods, there is no danger of applying excessive pressure to the seal nor of liquid slugs returning to the compressor.

Defrosting takes place at such a rapid rate that little loss of refrigeration occurs even with natural draft coils. The rapid rate of defrosting is due to the fact that all the condensate is removed almost as soon as it is formed, thus allowing the hot gas to reach all parts of the coil and because a constant supply of hot gas is available from the compressor which is working on the other evaporator.

The hot gas line should be of equal size to that running between the compressor and the condenser. The same type of valves as recommended for use with Figs. 1 and 2 should be employed with these circuits and a similar chart should be supplied.

De-freezing the Drip Pan

Since the ambient temperature is always below the freezing point of water the drip pan has a tendency to freeze up, as has also the drain line. This may be easily overcome when using hot gas defrosting on blower type units, by providing a drain line of sufficient size so that the hot gas line may be run inside it and still leave plenty of space for the draining of the drip water. The hot gas line should make several turns inside the drip pan and may then be run to the proper point and connected to the evaporator. By looping the hot gas line upward at this point and entering the tee from the top, all liquid refrigerant will be trapped out and as a result the hot gas line will not frost up during normal operation.

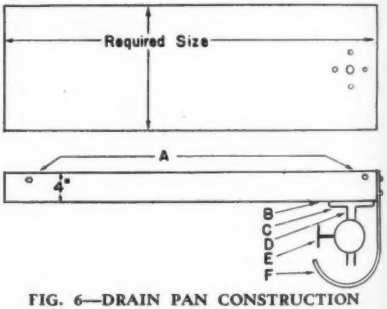


FIG. 6—DRAIN PAN CONSTRUCTION

If, due to the construction of the unit, it is not convenient to run the hot gas line as above, heat exchanger fittings may be applied to the drain line and the hot gas caused to pass through the outside tube.

When the hot gas method is not used and electric heat or some other type of defrosting is employed, the incoming liquid from the liquid receiver may be used for the same purpose with almost equal results.

Where natural draft coils are employed the above methods may be used if practical or a portable drip pan may be made up as illustrated in Fig. 6. This pan may be suspended from each evaporator in turn, as it is defrosted, and when filled, the condensate may be drained into a pail suspended on the hook, by opening the hand valve. This makes the pan much easier to handle and there is little chance that the workman handling it will be drenched with water.

Cleaning Receivers

By L. K. WRIGHT

SHOP overhauling and reconditioning of high sides should include the testing and cleaning of the inside of the welded or sealed steel receivers used on air-cooled apparatus and the brass, shell-type of condenser-receiver vessels found in some water-cooled systems.

The flanged or bolted type of condenser-receiver assemblies can of course be opened up; the water coil removed and the inside of the vessel cleaned with steel wool. Flange faces can be scraped clean with a piece of copper or brass. A piece of half-inch copper tubing with one end flattened and filed into a scraper is excellent. Being of soft metal, softer than iron or steel, such a scraper will not damage the faces, whereas a steel scraper may gouge out pieces of metal or leave deep scratches on the surfaces, making it difficult to effect a tight joint.

Such assemblies as the flanged or bolted types are obviously easy to clean. The sealed, welded types offer some difficulty and this article covers the cleaning of these latter models.

Preliminary Testing

After removal of the receiver from the machine base, plug one of the refrigerant openings and connect the other opening to a source of air pressure. Apply a pressure of from 190 to 220 lb. per square inch. Test for leaks by submerging in a water bath or by applying a thick solution of soap suds; the former being the quickest and most certain method of testing. If the receiver is to be submerged in water a flexible line or a looped copper line will make the job easier. Leave the vessel under water for several minutes and check for bubbles. A good light will aid in detecting minute leaks.

If the vessel appears in a generally sound condition any small leak can be repaired by soldering, welding or brazing; whichever method was used in the original assembly. After repairing any small leak repeat the test and prove the vessel tight.

Preliminary Cleaning

Use clean water-white kerosene and fill the receiver about one-third full. Plug openings and rock or shake the vessel, turning it so the kerosene can clean every part of it.

After a thorough shaking empty the vessel and repeat the process with clean kerosene. If this oil is clean after draining from the receiver, let the receiver stand so it will drain thoroughly. Should the kerosene be discolored after this second cleaning repeat with a third or even fourth washing.

Rust and Scale Removal

Put about one-half pint of Rusticide and a couple of handfuls of diagonal steel shot into cleaned receivers of ⅓ to ½ hp. size and plug the openings. Use more shot in proportion for larger sizes and increase the amount of the cleaning agent as well.

Place the receiver in a tumbler or rotating machine and allow the cleaner and shot to be tumbled for a period of about 15 minutes. Then remove the receiver from

its rotating stand and drain off the Rusticide.

The shot should be left in the receiver, for both receiver and shot must be washed to remove the acid cleaning agent.

Shot

Diagonal shot, about 3/16 x 3/16 inch can be purchased locally of dealers in electroplating supplies or may be obtained direct from The Hartford Steel Ball Company, Hartford, Conn.

This type of shot appears to work best for cleaning receivers, but other varieties of edged shot can be used if they are on hand. The smoother or more regular the surface of the shot the longer the period of tumbling required for the job.

It is best to clean the shot if it has been used for some other job or employed with

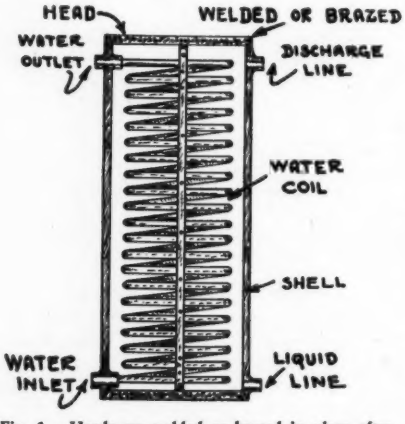


Fig. 1.—Heads are welded or brazed in place after the water coil has been set in place. Clean interior of shell and water coil.

another cleaning agent. A ten pound lot of the diagonal shot will serve for a moderate sized shop and as it is used over and over again it will last a long time.

Shot that is to be stored for a time is best kept in a sealed tin can with kerosene or a mixture of oil and kerosene, to prevent rusting.

Rusticide

"Rusticide" is a product of the Rusticide Company of Cleveland, Ohio, and is sold in five gallon containers. It is a rust dissolving compound composed of sulphuric and phosphoric acids, together with an inhibitor which prevents the acids from attacking iron after the rust or scale has been removed.

This inhibited acid mixture should be handled with the usual precautions exercised when handling acids. It will attack shoes, clothing and concrete.

While the gas produced during the action of the acids on the rust and scale is not harmful, it can be vented to the outside, for the violent preliminary action some times carries some acidulated spray along with the gas.

Inhibited Acid Formula

For those who desire to make up their own inhibited acid solution, the following formula may be used:

Water.....78 parts by volume
Commercial Hydrochloric (Muriatic) Acid, having a specific gravity of 1.19.....22 parts by volume
Inhibitor Powder (Phosphene G N)
13.5 oz. per 50 gallon of the acid mixture, or
0.27 oz. per gallon.

The proportions of this formula should be maintained with five per cent for best results.

To mix the solution it is best to use a wooden barrel or tub, first filling with the calculated amount of water. Then add the inhibitor powder, stirring while adding and continuing to stir until dissolved. When completely dissolved the acid may be added, adding it slowly and stirring the while.

Quantity Required

As a rough idea of the quantity required is of value in preparing solution, the following quantities will be found to be the average:—

⅓ H.P.	1 pt.
½ H.P.	1 qt.
¾ H.P.	1 qt. 1 pt.
1 H.P.	2 qt.
1½ H.P.	2 qt. 1 pt.

Where "Rusticide" is used about half the quantity advocated above should be used. In either case use shot with the solution for proper cleaning.

Cleaning Receiver

To clean the receiver after draining of Rusticide or inhibited acid, fill it about half full with boiling water and rock it back and forth, turning the receiver so all internal parts are washed free of the acid.

Drain off this first wash water and refill

with boiling water, rocking well for several minutes.

Drain off the second wash water and empty the shot into a perforated pail or can, so as to save the shot. Hold the pail under running hot water as an additional rinse and then dump the shot into a pail that has a false bottom raised several inches from the bottom of the pail. Have this pail filled half full of kerosene with some carbon tetrachloride added to it. Keep cover on pail to prevent loss of carbon tetrachloride through evaporation. Such procedure will preserve the shot and it will last a long time.

The receiver in the process of cleaning should be filled the third time with boiling water and rocked well. Then drain out, catching a small glass of this rinse water for test purposes.

Testing for Acid

Drop a few drops of methyl-orange into the sample of the rinse water. The presence of acid is indicated by a change in color. If acid is indicated repeat rinsing until no color change is noted.

This methyl-orange test solution can be obtained from any drug, drug supply or laboratory supply store. It is best transferred to a small bottle having a combination stopper and dropper, so the solution can be used easily. To test, only a drop or two is needed at a time, thus forming a cheap but positive means of testing for neutral condition.

Neutralizing

When the rinse water tests neutral with the methyl-orange indicator the receiver should be given about a quart of boiling water, followed by about a tablespoonful of drug store ammonia (26 degree aqua ammonia).

Insert plugs and rock receiver back and forth, turning it over and over, to permit the ammonia to contact all surfaces and neutralize any tiny trace of acid held in a rough place, such as at a weld or a seam. This quantity of ammonia will not harm any brass or copper part, as there is not enough of it to cause any damage. Do not, however, increase the quantity of aqua-ammonia as an overabundance may attack the copper coil or any brazed section. Ammonia is not harmful to iron or steel and will not affect it in the least.

Empty the receiver of the water and ammonia neutralizer and then blow out moisture with compressed air. By use of a small electric light bulb dropped into one of the openings, inspect the interior condition for scale or rust. If clean and the interior does not show marked pitting, the receiver can be processed further. Should deep pits be observed, such as might make for a failure in service, the receiver should be scrapped. Light coatings of scale indicate insufficient cleaning time, poor or smooth shot, or a weak acid cleaner. The receiver is best sent through the entire cleaning process again if scale is observed, to insure a clean job.

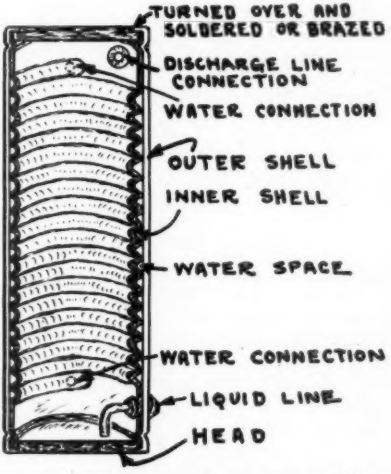


Fig. 2.—This type of condenser-receiver consists of a smooth outer shell pressed over an inner shell which has a spiral groove formed in it. Water passes in these grooves or convolutions between the inner and outer shells. Clean water passage as well as interior of inner shell.

Pressure Test

Hook the receiver up to a source of air pressure and test under water for at least three minutes at 190 to 220 lbs. of pressure per square inch. Repair any leaks as per previous advice regarding same.

A receiver proven satisfactory should have one plug inserted tightly, or if valves are part of the design, have the valves in place and close one of them. Connect the open port to a vacuum line.

Hold the vessel under a vacuum of 25 or more inches, for ten hours or overnight, in an oven at a temperature of 175 to 210 degrees F.

Where a valved receiver is involved, close

the valve before removing from the vacuum line. Then attach a copper line and dip the end into a vessel of refrigeration oil. Allow about a half pint to be drawn into the receiver. This oil will prevent rusting. Turn the receiver over and over to distribute the oil evenly about the interior.

Receivers without valves require the oil to be poured in and then sealed with plugs.

Tumbling Machine

An effective tumbling machine can be made from the frame of an old wood-turning lathe. Fix two discs or arms to the head and tail stocks, with long bolts so arranged as to grip the ends of the receivers. The tail stock should be set off center to produce a wobbling or tumbling action. Belt or gear to a ⅛ or ⅙ hp. motor, so that the tumbler revolves between 40 and 50 revolutions per minute. Higher speeds are of no value and slower speeds than those recommended will only lengthen the time of tumbling.

Perforated Shot Container

Some shops have a small can with a perforated bottom and provided with legs so as to keep this can several inches from the bottom when set into a larger can holding the kerosene. This small can is easy to pull out and the shot can be rinsed in hot water and dumped into the receiver, using a funnel.

The false or perforated bottom idea permits dirt and water to fall to the bottom of the kerosene container, where it will not corrode the steel shot. Periodically it can be removed and the bottom cleaned of sludge.

Cleaning Water Coils

Hard water, found in many localities, will build up a coating inside the water coil or channel. This is difficult to remove in some cases. In most instances, however, the cleaning agent will remove this scale.

To clean a water coil or jacket plug one end—the lower end—and fill the coil with the acid solution. Caution must be used as in some cases violent foaming occurs and this may spray some of the liquid about the shop.

Some operators attach a tee to the filling end of the coil, the side opening connected by means of a rubber hose to the acid supply, while the other opening is fitted with a nipple and a bushing or drilled cap to take a piece of two inch pipe, so if foaming occurs some of the liquid will lift up into the large piece of pipe. When foaming subsides the liquid will run back into the coil.

Test all coils under water at 200 pounds pressure and prove tight before reassembly.

There are many old ammonia machines which have shell type condensers, or shell and coil construction. Being of steel they rust up rapidly. To replace them would involve considerable expense; therefore try cleaning them as outlined. This can be done rather cheaply and will give considerable saving in water and electric consumption.

Refrigerating Shasta Dam

By JOHN SCHLEMMER *

WHILE the use of refrigeration to cool the great masses of concrete used in building dams is not new, due to the magnitude of the job to be done it is always interesting.

Shasta Dam (now under construction) is located about ten miles out of Redding, California, on the Sacramento River. It is larger than Boulder Dam, and when completed will provide power and irrigation for a large surrounding area. Its backwaters will completely flood the early mining town of Kenneth and the railroad which follows the river through the mountains. The railroad will be rerouted and a tunnel constructed through Mount Shasta.

The chemical reaction in setting concrete creates heat and the total amount of heat generated in such huge masses as used in this dam would require a period of years to properly cool by natural means. In order to prevent undue cracking of the concrete, cooling must be accomplished uniformly throughout the mass and if it is not completed before the cold waters from snow-covered Mount Shasta pour against the outer surfaces, cooling on the outer part would be too rapid and the resultant uneven contraction would cause large leaks in the dam. It, therefore, becomes necessary to cool the entire mass through mechanical means within a comparatively short time to the temperature of the coldest water that will eventually come in contact with it.

*California Refrigerator Co., San Francisco, Calif.

(Continued on page 60)

Motor Capacitors

Observations on the Use and Replacement of the Electrolytic Type Condenser

By LOUIS KAHN *

THE majority of fractional horsepower single-phase motors in use today are of the capacitor-start type. These motors are used in refrigerators, oil burners, air conditioning equipment and many other units requiring a motor that can develop a high starting torque with a minimum line current.

The use of this method of starting is not new, but its practical application was not achieved until the production of a low-priced, long-life electrolytic capacitor was attained. Such capacitors were evolved from the radio type units, but, because of the severer operating conditions, an entirely different type of construction is necessary. Unlike the d.c. capacitor, as used in radio receivers, there is only a.c. applied to the motor-starting capacitor, and the currents that flow through it are many times greater than in the receiver-type unit.

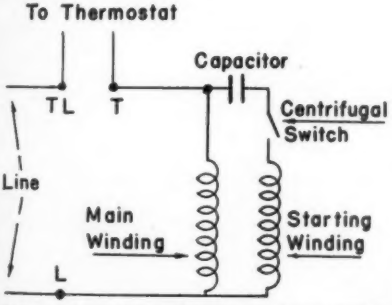


FIG. 1—WIRING DIAGRAM OF CAPACITOR MOTOR

The detailed theory behind the use of a capacitor for starting single-phase motors can be obtained from any treatise on a.c. machinery. In the following will be discussed the practical considerations in the use and replacement of these condensers.

The capacity used for any motor is chosen to give the maximum starting torque. This is determined by the motor manufacturer. In the field, when the replacement of the capacitor is necessary, the replacement unit should have the same capacity as the original unit. If the identification marks on the original unit are lost, the serviceman must determine the proper sized unit to be used.

The circuit diagram of a typical capacitor-start single-phase induction motor is shown in Figure 1. The purpose of the capacitor is to produce a current in the starting winding which will produce a magnetic field that will combine with the main winding and produce a high starting torque. The current that flows in the starting winding is determined by the voltage of the line and the design of the starting winding.

If various sized capacitors are used on a motor and the starting torque and voltage across the condenser are measured, a curve similar to that of Figure 2 is obtained. The torque rises rapidly, and, after reaching its maximum value, slowly decreases. In the vicinity of the maximum value a fairly large change in capacity produces a relatively small change in torque. This is advantageous, as the relatively wide tolerance in the capacity of the capacitor keeps the cost of the unit down. The voltage across the capacitor reaches its maximum value before the torque and then starts to decrease. Since the voltage across the capacitor is determined by the design of the starting winding and the line voltage, the voltage across the capacitor is a good indication of the proper sized capacitor.

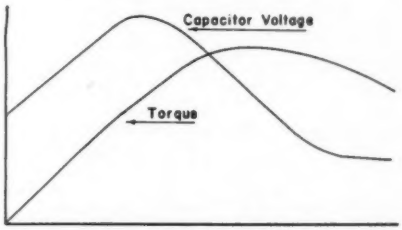
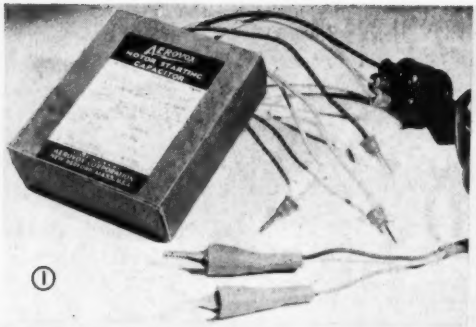


FIG. 2—SHOWING RELATION OF CAPACITOR VOLTAGE RISE TO TORQUE INCREASE

* Engineering Staff, Aerovox Corporation.



VIEWS OF THE MOTOR CAPACITOR TEST SET IN USE

(1) Emergency capacitor for motor-starting jobs. Note different leads and plugs, together with connector, for joining any combination of sections to gain desired total capacity. Clip connectors serve to connect capacitor in place of discarded capacitor.

(2) Plugging different leads of sections into the group connector, so as to obtain the required total capacity value for best motor-starting characteristics.

(3) Placing an emergency capacitor in place, so as to get the motor going until such time as an exact-duplicate capacitor can be permanently installed.

(4) Motor-starting capacitor-selector which indicates the best capacity value for a given refrigerator motor. The toggle switches serve to cut in various sections of the capacitor, while the voltmeter indicates voltage at moment of starting, which must not exceed 138 volts.

(5) Serviceman ascertaining the best capacity value to use for a given motor. The voltmeter indicates the voltage at moment of starting.

Standard practice today calls for a maximum capacitor voltage of 138 volts during the starting period for a 120-volt motor. This voltage lasts for a very short period of time, usually less than one second. Higher voltages, such as occur with undersized capacitors, will decrease the life of the capacitor markedly. The use of undersized capacitors will not prevent the motor from starting, but it will increase the starting time and the voltage across the capacitor.

Since electrolytic motor-starting units are not continuous-duty units, the excessive voltages and starting period that occur with improper capacitors decrease the life of the unit. If the capacitor is too small, the torque produced may be insufficient to bring the motor speed up to the point at which the centrifugal switch disconnects the capacitor from the line. Under such conditions the capacitor soon fails by drying out. The starting period should not exceed five to ten seconds in a properly functioning motor.

Choosing Correct Capacitor

To facilitate the choice of a correct sized capacitor for a motor, the unit described below is of great benefit. It consists of tapped electrolytic capacitor having taps so arranged that capacitors from 65 mfd. to 125 mfd. can be obtained. A voltmeter having a range of 0-150 volts a.c. is included to determine the line voltage and the capacitor voltage. The proper sized capacitor is found by first connecting the test capacitor for 65 mfd. to the motor leads and starting the motor. As the motor starts the maximum voltage across the condenser is noted and the time for the motor to come up to speed observed. Then 15 mfd. is added to the 65 mfd. capacity already connected and the motor started again. The voltage and time are observed once more and compared to the values noted on the first test. If the time required to start the motor decreases, the next tap is connected and the test repeated. Capacity is added until the voltage across the capacitor is 138 volts or less and the starting time is a minimum. Higher capacity will decrease the capacitor voltage, but also will decrease the starting torque. Thus, the use of capacities greater than the optimum value is not advantageous.

The unit described above has another application that the serviceman can use to advantage. With such a capacitor in his kit he can quickly replace, temporarily, any defective capacitor, without carrying a large number of standard capacitors. The voltmeter is not necessary for this purpose and can be omitted. The unit should not be used for permanent replacement as it is purposely made much smaller than the standard sized units and therefore cannot be used for permanent installations. With such a unit available, the serviceman can make immediate repairs if the capacitor is at fault, and then obtain the correct replacement unit for a permanent repair.

It should be noted that there are other sources of motor trouble that will prevent the motor from starting. The three most probable reasons for improper starting of capacitor type motors are: (1) excessive torque requirements due to binding in the compressor, (2) excessive torque due to friction in motor bearings, and (3) a defective centrifugal switch. The defective motor should be checked for these faults before any attempt is made to replace the capacitor.

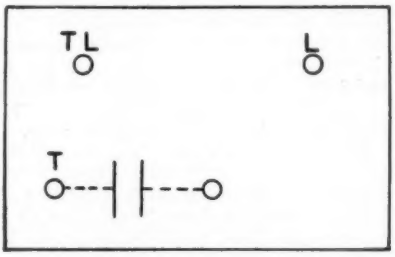


FIG. 3—CAPACITOR TERMINAL BOARD

If the motor is of the totally enclosed type, such as is used in many refrigerators, the test can be made by connecting the voltmeter across the capacitor and an ammeter in series with the main motor windings. Voltage is applied to the motor terminals and the line current and the capacitor voltage noted. The normal motor current can be found on the motor name plate and by comparing the actual current drawn by the motor to the name plate value and by noting the capacitor voltage, the difficulty can be discovered.

If the motor starts but takes a long period to come to speed, and the line current does not come down to the rated value, the difficulty is excessive load on the motor. This is a mechanical problem. If the motor does not start and there is no voltage across the capacitor, the capacitor may be shorted or the starting winding circuit may be open. The capacitor should be disconnected and the voltmeter connected to the motor ter-

minals to which the capacitor is normally connected. If the starting winding circuit is open, no voltage will appear across these terminals when the motor is connected to the power line.

The 4-terminal type capacitor terminal board is shown in Figure 3. Terminals "T" and "TL" are blank terminals not connected to the capacitor and are used for convenience in interconnections. The capacitor in the container is brought out to the terminal "T" and the unmarked terminal.

Fourth Article

Simplified Air Conditioning

This month's article takes up the subject of dry bulb and wet bulb temperatures, discussing at length their difference and use.

By GEO. G. BORDEN

DRY bulb temperature is the temperature recorded on an ordinary mercury thermometer. In winter time, we try to maintain a constant temperature in our homes and offices of around 70 degrees. This is the dry bulb temperature of the room.

Dry bulb temperature is a measure of the sensible heat in the air. You will recall that sensible heat is the kind of heat that causes a change in temperature. The warmer air is or the higher its dry bulb temperature, the more sensible heat it contains.

In the case of water we learned that in order to raise the temperature of one pound of water one degree F., one B.t.u. had to be added to the water. Thus, to raise the temperature of one pound of water from 32 degrees to 82 degrees, 50 B.t.u. would be required. Conversely to drop the temperature of one pound of water from 82 degrees to 32 degrees, 50 B.t.u. must be removed from the water.

Now in order to raise the temperature of one pound of dry air one degree F., 24 B.t.u. must be added to the air and this heat is sensible heat. This figure (.24 B.t.u. per pound) is important because we can use it in checking the capacity of air conditioning equipment. For instance, if air enters a piece of cooling equipment at 80 degrees and comes out of the equipment at 60 degrees, the machine must have picked up (80-60) $\times$ .24 = 4.8 B.t.u. of sensible heat from every pound of air passed through the machine. But you'll say, cooling machines are rated in cubic feet of air per minute (c.f.m.) and not in pounds of air so how can we use this figure of .24 B.t.u. per pound. For all practical purposes a cubic foot of air weighs .075 pounds. This is another important figure for us to remember.

Thus if we are testing a machine that is delivering 1000 c.f.m. of air at 60 degrees with the entering air at 80 degrees, the machine is removing 21,600 B.t.u. of sensible heat from the air each hour. This is figured as follows:

1000 $\times$ .075 = 75 pounds of air per minute.

75 $\times$ 60 = 4500 pounds of air per hour.

(80—60) $\times$ .24 = 4.8 B.t.u. removed per pound of air.

4500 $\times$ 4.8 = 21,600 B.t.u. per hour sensible heat.

Suppose we had a three-ton unit which handled 1500 c.f.m. of air entering at 82 degrees and leaving at 63 degrees. What would the sensible heat capacity of this machine be?

The answer is 30,780 B.t.u. per hour sensible heat. Can you work it out?

Suppose you knew that a five ton job had a sensible heat capacity of 40,000 B.t.u. per hour at 1800 c.f.m. You wanted to test the machine to see if it were delivering full capacity, how could you do this?

You could determine the temperature difference between inlet and outlet grills with a thermometer. Then knowing the temperature difference you could figure what the sensible capacity of the machine was. As we go along in this series of articles we will

find that the sensible heat capacity of cooling equipment will vary depending on the amount of moisture in the entering air but at this time we should appreciate the importance of dry bulb temperature.

Wet Bulb Temperature

Wet bulb temperature is the temperature recorded on an ordinary thermometer, the bulb of which is wrapped with a piece of clean silk or muslin that has been thoroughly saturated in water. Hence, the name wet bulb thermometer.

When we wet a piece of cloth and then allow air to pass over it, the cloth will dry, that is the water will evaporate, change from a liquid into a gas and leave the cloth. We learned in last month's article that in order to change a liquid into a gas or vapor, heat must be absorbed from somewhere. In the case of the wet bulb thermometer heat is absorbed from the air immediately in contact with the rag and the air temperature near the rag is lowered. This causes the wet bulb thermometer to read lower than the dry bulb thermometer as long as the rag is wet.

In order to get a true wet bulb reading, it is necessary that air be made to pass over the rag at a speed of about 900 feet per minute, and for this reason an instrument called the sling psychrometer was developed. A sling psychrometer is nothing more or less than a convenient holder for two thermometers (one a dry bulb and the other a wet bulb) with a chain attached to the holder so that it can be swung around in the air. One of these instruments is shown in Figure 1.

You can use your ordinary thermometer to get the wet bulb temperature just by wrapping it with a piece of silk saturated in water and then swinging the thermometer at the end of a piece of cord.

When the wet bulb and dry bulb temperatures are known, the relative humidity of the air can be found by referring these two temperatures to a psychrometric chart. This chart also provides a means to determine many important properties of air such as total heat per pound or per cubic foot of air, volume of air per pound, grains of moisture per pound or per cubic foot of air, and similar information that we will discuss at length.

The important fact to remember is that wet bulb temperature is a measure of the total heat in the air, not the latent heat. When the wet bulb temperature alone is known, the total heat in air can be found.

If we know the wet bulb temperature of air entering a machine, and the wet bulb temperature leaving a machine we can determine the total heat pick up of the machine. (You will recall that total heat is a sum of latent heat and sensible heat.) To determine the total heat pick up, we refer the entering wet bulb temperature to the psychrometric chart and find the total heat in each pound of air entering the machine. Then we refer the leaving wet bulb temperature to the psychrometric chart and find

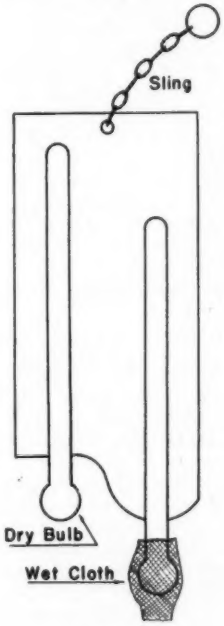


FIG. 1

the total heat in each pound of air leaving the machine. By subtracting the total heat entering from the total heat leaving, we can find the amount of heat picked up from each pound of air by the machine. For instance, suppose that we have a two-ton air conditioner into which is passing 1000 c.f.m. of air at 67 degrees w.b. and the leaving air is at 60 degrees w.b. How many B.t.u.s of total heat is the machine removing from the air?

From the psychrometric chart which we will discuss later, we find that the total heat in one pound of air at 67 degrees w.b. is 31.15 B.t.u. per pound. The total heat in one pound of air at 60 degrees is 26.18 pound.

The unit must be removing 31.15 — 26.18 = 4.97 B.t.u. of total heat from every pound of air passed through it.

We learned earlier that one cubic foot of air weighs .075 pounds so that 1000 cubic feet per minute means that the equipment is handling 75 pounds of air per minute or $75 \times 60 = 4{,}500$ pounds of air every hour. The heat removed from this air in one hour's time will be

$4500 \times 4.97 = 22{,}365$ B.t.u. per hour total heat

Let us work through another example. A three ton machine handles 1800 c.f.m. of air entering at 65 degrees w.b. leaving at 59 degrees w.b. What is the total heat capacity of the machine?

Air at 65 degrees w.b. holds 29.65 B.t.u. per pound whereas air at 57 degrees w.b. holds 24.25 B.t.u. per pound. The heat removed per pound is therefore

29.65 — 24.25 = 5.4 B.t.u. per pound.

1800 c.f.m. = $1800 \times .075 = 135$ pounds per minute.

Pounds per hour = $135 \times 60 = 8{,}100$ pounds per hour.

Total heat removed = 43,740 B.t.u. per hour.

Dew Point Temperature

We have already learned that the dew point temperature is the temperature at which the air becomes 100 percent saturated. The important fact to remember about dew point temperature is that the dew point is determined solely by the amount of moisture in the air. The more moisture in the air the higher its dew point temperature. Now the amount of moisture in the air tells us how much latent heat there is in the air because every particle of water vapor in the air originally was a particle of liquid water. Latent heat had to be added to this liquid in order to change it into a vapor and hence, the more water vapor in the air (the higher the dew point temperature) the more latent heat the air contains.

The water contained in a pound of air is a very small quantity and for that reason we seldom talk about pounds of water or ounces of water suspended in the air. Rather we weigh this water in grains.

One grain weighs 1/7000 pounds or in other words, one pound contains 7000 grains.

In a previous article we learned that if we leave an open pan of water in a room that the water will all disappear after a period of time. The water will have evaporated (changed from a liquid into a vapor and gone off into the air). In order to have a liquid change into a gas, latent heat must be added to the water. In the case of evaporating water, this heat was taken from the surrounding air. In order to evaporate one pound of water, 1,050 B.t.u. must be added to the water.

By the same token, in order to remove one pound of water from the air, 1,050 B.t.u. must be removed from the water in the air. The amount of this heat that is removed from the air is called the latent heat capacity of the machine.

If a five-ton machine has a latent heat capacity of 20,000 B.t.u. per hour, this machine can remove 19 pounds of water from the air each hour. This is obtained as follows:

$$\frac{20{,}000}{1{,}050} = 19 \text{ pounds}$$

A pint of water weighs approximately a pound so that this five-ton machine will remove about 19 pints or 2⅓ gallons of water each hour from the air.

Calculating Machine Capacity

If we have air entering a unit at a dew point temperature of 60 degrees and leaving a unit at a dew point temperature of 55 degrees, we can readily determine how much moisture is being removed by the machine each hour.

From the psychrometric chart air at 55 degrees dew point holds 64 grains per pound, whereas at 60 degrees dew point, air holds 78 grains per pound. Hence, in dropping the dew point from 60 degrees to 55 degrees 78—64 = 14 grains of moisture are removed from each pound of air passed through the machine.

If the machine handles 2000 c.f.m., the weight of air handled per hour equals

$2000 \times .075 \times 60 = 9{,}000$ pounds per hour

$9000 \times 14 = 126{,}000$ grains per hour

$$\frac{126{,}000}{7{,}000} = 18 \text{ pounds of water per hour}$$

(To be Continued)

H. G. Dittman
New York

I have been a subscriber to THE REFRIGERATION SERVICE ENGINEER since August, 1938, and it is without a doubt the best of its kind, as I get much valuable information from it which would be very difficult to secure elsewhere.

SERVICE KINKS

Tools and Equipment You Can Build

Under this heading will appear simplified or short cut methods of performing individual service operations; also details of how you can build special tools and equipment for your own use. Readers are invited to submit information for publication under this head.

A SERVICE KINK "KINKED"

SERVICE Kink Dept.: On page 17 of the March issue of this publication an article appeared dealing with the cleaning of metal surfaces, and while this obvious error escaped our notice when we first received it, one of our clients, who is a subscriber, has written to us stating that after trial of the procedure detailed he has found that parts have been badly corroded after 1½ hours immersion in the bright dip solution.

Obviously the length of time stated in the article is entirely incorrect as, from our own experience, we find that 4 or 5 seconds immersion of non-ferrous parts in a bright dip solution, consisting of two parts Sulphuric Acid, one part Nitric Acid, is quite sufficient to remove all stains, etc., and give the parts a bright appearance providing they are thoroughly washed immediately after removal.

It is not our practice to use a bright dip on ferrous parts as a rule, as considerable rusting and corrosion takes place once they are removed from the acid solution, irrespective of the amount of washing and drying they receive subsequent to the dipping.

E. Ebeling,
F. C. Lovelock Pty. Ltd.,
Sydney, Australia.

ANSWER: You will note that the article in question referred primarily to the cleaning of compressor parts which are usually of steel or cast iron. The cleaning of these parts in a 50% solution of muriatic acid and water work very satisfactorily in our experience and though the time required for cleaning may be as little as fifteen minutes when the acid is still strong and has not been used too much, we find that it does the parts no harm to stand in the solution four to five hours and it assures you of a thorough cleaning unless there is grease on the surface.

It is true that these parts will rust very rapidly after removal from the bath but this is not due to the acid any more than it is to the Oakite bath. It is due primarily to the fact that all oil and grease has been removed from the metal, leaving it with no protection against rust. If the parts are coated with oil, wax or some of the rust preventative solutions immediately after removal and drying the rust will be eliminated.

The article stated that brass and copper parts may also be cleaned in the bath. This statement is true although probably misleading since the solution is called "bright dip" and as such it is expected that the parts will be restored to their original color and brightness.

The method described will clean brass or copper, steel or cast iron parts of rust, carbon scale, liming or almost any dirt or corrosion that it may contain, but it will not restore brass and copper to its original color.

Sulphuric and nitric acids are so much stronger than muriatic and attack the metals so much faster that four or five seconds immersion in it would be sufficient. Furthermore, because these acids actually eat away part of the metal surface the metals are restored to their original color. Sulphuric and nitric acid, therefore, make a better and faster acting "bright dip"—especially when used on brass and copper. However, these acids are much more dangerous to use and much more difficult to store than diluted muriatic and for this reason we are inclined to recommend the use of muriatic.

It does a good job on steel and cast iron leaving the metal clean and bright but, while it cleans copper and brass of scale, it will not leave this metal bright.—H. B.

S S S

John E. Herson
New Jersey

Find enclosed $2.00 for the renewal of my subscription to THE REFRIGERATION SERVICE ENGINEER, which has expired. Please send me the back issues that I have missed. THE REFRIGERATION SERVICE ENGINEER is the best ever.

THE "KINKS" THAT JACK BUILT

J. JOSEPHSON

WHEN it comes to Service Kinks, Jack Josephson of Josephson's Electric Refrigeration Service really has them. All the kinks appearing in this issue have been supplied by Jack and there are many more to come in future issues. Jack claims that all these service methods are used in his shop, which is pictured below. He believes in testing everything and in having a means of doing it. Furthermore, he believes in passing on the ideas to others who may not have heard of them.

JACK JOSEPHSON'S SHOP IN BRIDGEPORT, CONN.

Motor Bearing Extractor

By JACK JOSEPHSON
Josephson's Elec. Refrig. Serv.
Bridgeport, Conn.

A VERY useful bearing puller can be easily made from material available in your shop in accordance with the details shown in Fig. 1.

"A" is a piece of round machine steel turned down in a lathe and threaded with a ½ inch thread. If you anticipate using the puller on motors with shafts smaller than ½ inch, this thread will also have to be smaller.

"B" is a piece of flat steel stock about ¼ inch thick, shaped as shown. The hole in the center should be slightly larger than ½ inch.

"C" is one of a number of assorted sizes of steel water pipe. The inside diameters of the pieces should be slightly larger than the outside diameters of the bearings to be pulled. Several pieces of different sizes may be accumulated according to your needs.

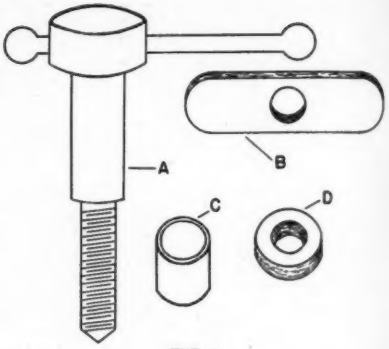


FIG. 1

The inside may be machined in a lathe in order to make it conform to size.

"D" is one of a number of pieces cut from round machine stock about ¼ inch thick. The outside diameters of the pieces will vary and should be slightly smaller than the outside diameter of the bearing to be pulled. The inside of each piece should be drilled and tapped to fit the thread on "A."

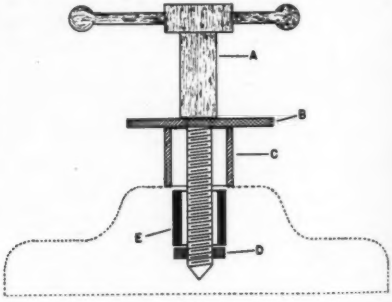


FIG. 2

The parts are assembled as in Fig. 2 when pulling a bearing. To install a bearing, just turn the motor bell over using the puller in the same manner as shown except that part "C" will not be needed.

S S S

Seal Testing Tool

By JACK JOSEPHSON

TIME can be saved and much guesswork eliminated by providing yourself with a test jig for your compressor seals, such as shown in Fig. 1.

In constructing the jig, block (A) is a

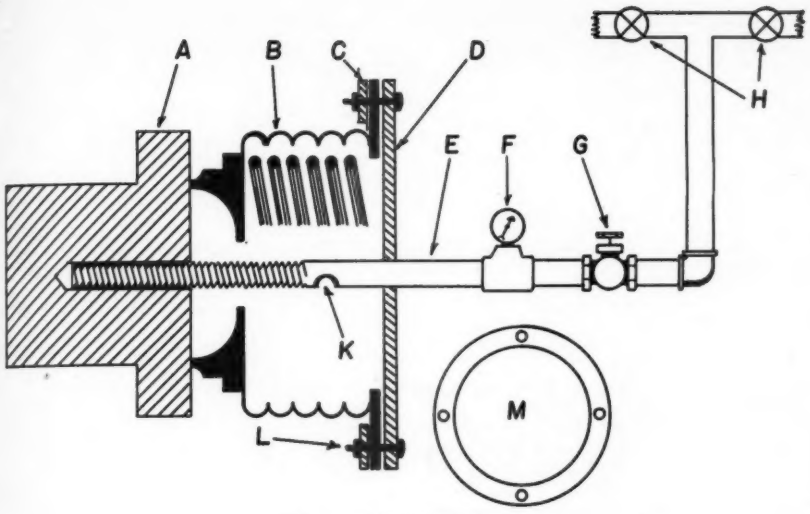


FIG. 1—SEAL TESTING JIG

A—Tool face block.
B—Seal under test.
C—Clamping ring.
D—Tool base.
E—Threaded steel pipe.
F—Compound gauge.
G & H—Globe valves.
K—Holes filed in pipe.
L—5/16 inch bolts.
M—1/2 scale view of ring used at (C).

piece of round steel stock machined down in a lathe. The small diameter end may be knurled or machined in an octagon shape to provide a grip. The face should be carefully machined and lapped to a perfect surface. The hole in the center should be drilled and tapped while the block is in the lathe so that the hole is perfectly aligned with the polished face.

The remaining parts need no further description other than shown in Fig. 1. The jig shown is a stationary fixture, permanently connected to pressure and vacuum lines. If it is desirable to make a portable jig (one that can be submerged in a water bath when testing for leaks) the jig can be provided with a 1/4 inch flare tube connector and a flexible tube or charging hose attached to it.

Using the Tool

After the seal has been repaired and lapped, place it in the jig using a good gasket coated with oil, between the jig base and the seal. Put a film of oil on the face of the block (A) and on the seal nose. Screw down on block (A) till the proper tension has been obtained. This will usually require depressing the seal about 1/8 inch. Open valve (G) and valve (H) leading to the pressure supply. Submerge the jig in water or cover with oil and watch for bubbles which will indicate leaks in the bellows. The pressure used should be about 60 lbs. gauge.

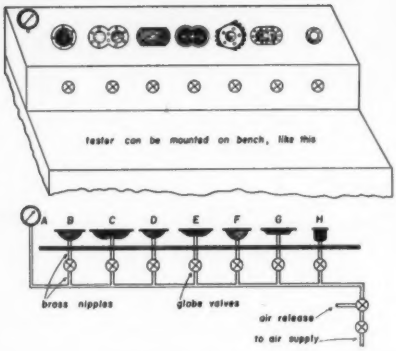
If no leaks appear, close pressure supply valve (H) and open the valve to vacuum. When 28 inches of vacuum show on the compressor gauge, close valve (G) and allow to stand for 20 minutes. If the gauge does not show any change after this period of time, the seal may be marked okay.

S S S

Valve Plate Tester

By JACK JOSEPHSON

THE pipe arrangement is made as shown, using original old cylinder heads desired. A heavy lead gasket is made for each head, or standard gaskets can be used. To test a discharge valve plate, bolts are inserted in holes of head, the plate being placed on the head upside down. After bolting securely the air is let in and the proper globe valve opened and a little oil put around the valve seat. If bubbles appear the valve leaks. The pressure gauge indicates the air pressure in the testing outfit, and can be left



on for a while to see if pressure is lost, before taking the plate off. The Fedders tester can be purchased through your regular jobber.

Those heads that have small holes or holes with no threads for nipples should be drilled for ¼ inch standard thread. Bolts on some heads must be inserted before screwing in the nipples to the cylinder head.

TESTING BOARD FOR ALL MAKES OF COMPRESSOR VALVE PLATES AND FEDDERS CARTRIDGE TYPE NEEDLE ASSEMBLY
A—Pressure Gauge.
B to G—Different styles and makes of compressor heads.
H—Fedders cartridge needle valve assembly.

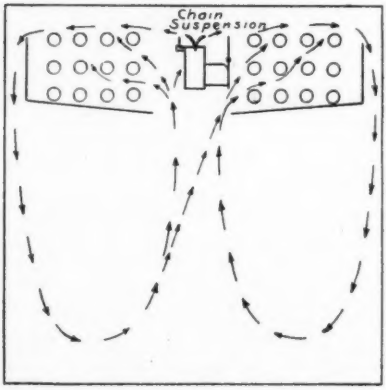
Fans in Coolers

FANS of the correct type and properly installed provide valuable aid in improving temperature and humidity conditions in coolers equipped with brine or direct expansion coils.

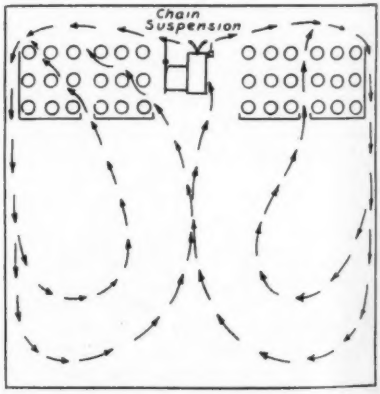
This fact seems to be quite generally appreciated, judging from the number of fans in use in coolers throughout the country. However, results are often disappointing, or not up to expectations, because apparently it is not understood just what is to be expected under certain conditions of fan installations, or how to go about it to get results that might be expected.

With certain designs of fans it is possible to prevent much if any ice formation on coils. If the refrigerant is run intermittently through coils it is possible with fans of the Action-Air type to defrost the coils. On the other hand, if the refrigerant is passed continuously through coils and one bank of coils can be turned off at a time, the latter can be defrosted while the refrigerant is passing through remaining banks.

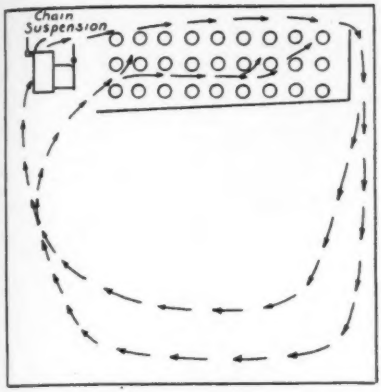
In coolers equipped with single or double bunkers natural draft can be reversed. The result in such cases is that induced currents will pass up through coils and join the air



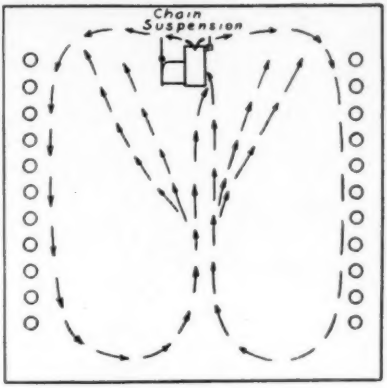
DOUBLE BUNKER COOLER.



CEILING COIL COOLER.



SINGLE BUNKER COOLER.



SIDE WALL COILS.

stream going over the top. By this method absorption of coils is greatly increased.

In blowing air over coils, and not through them, the air being handled by the fan does not come in contact with coils and moisture in this air does not adhere to coils. In other words, under such circumstances dehydration is not increased. The only moisture collecting on coils will be from the induced currents, which move slowly.

In some coolers there are banks of coils with drip pans underneath. In this type of construction the air-circulating device should be placed in center of cooler, so as to blow air over coils. Induced air currents with this arrangement will go through coils next to air circulator and join air stream through down draft openings. Result is that air is forced to side walls and drops to floor of its own weight.

Coolers With Side Coils

In coolers equipped with side coils an air circulator speeds up the natural draft. In such coolers, 20 to 30 ft. wide, air in center of cooler may be cold, but as there is little or no circulation, meat hung in this dead area does not keep as well as that on racks near coils.

Air circulation in these side coil coolers is such that only a small area of room, represented by a small ellipse, is effectively cooled. With an air circulator installed in center of room near ceiling, size of this ellipse is increased, and all sections of the room obtain air circulation. Temperature differential of air at floor and ceiling is also reduced.

With air circulators properly installed shrinkage of meat can be cut considerably. With the proper air circulation and an even temperature in cooler it is also possible to eliminate sweating, and to hold natural colors for longer periods.

The accompanying illustrations show approved methods of installing air circulators so as to get best results in coolers with different arrangements of brine and direct expansion coils. These sketches were prepared by the Brown Corp., Syracuse, N. Y., manufacturers of Action-Air, and are based on an extensive study of air currents in coolers under various conditions.

S S S

A. J. Ruehl, Jr.
Missouri

Find enclosed money order for $2.00 for which please continue my subscription with the January issue, as I do not want to miss a single copy of THE REFRIGERATION SERVICE ENGINEER. All the information printed in the R.S.E. is of great interest and very educational.

S S S

Jess Morgan
Arkansas

I read every issue of THE REFRIGERATION SERVICE ENGINEER journal from front cover to the last page. It's just full of information for the serviceman who wants to keep up with the latest types of equipment, and know what's going on in the refrigeration business. I don't see how any serviceman could be without the R.S.E. if he intends to stay in business and render efficient service.

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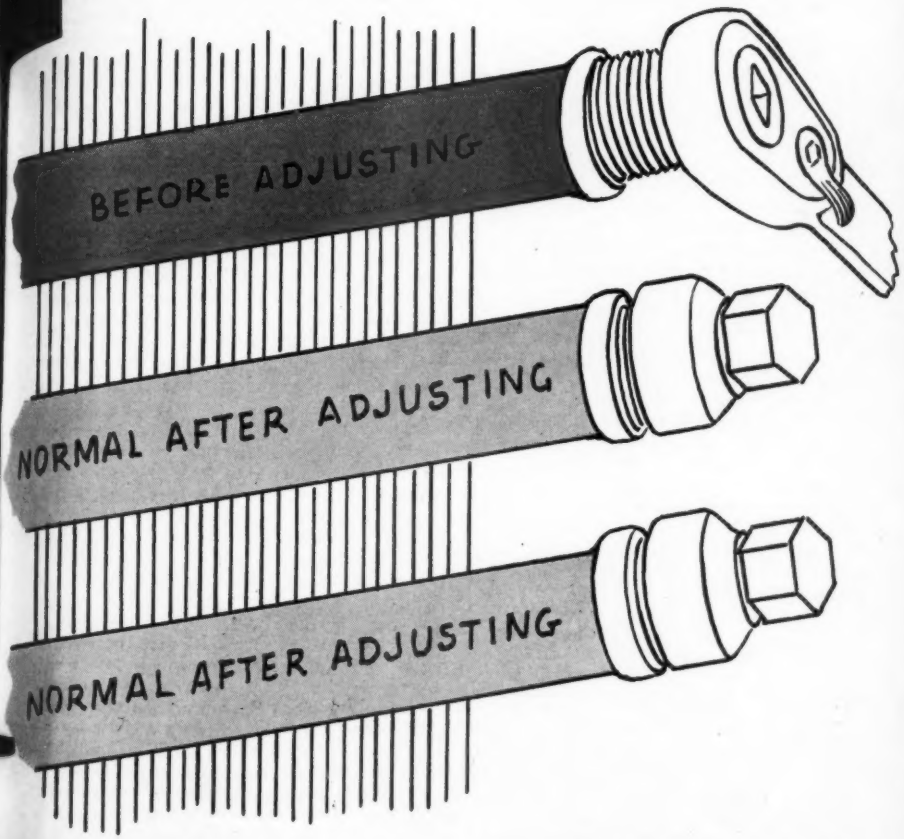

CTURING CO., 57 TONAWANDA ST. BUFFALO, N. Y.

COPY OF THE FEDDERS NEWS?

The Question Box

Readers are invited to send their problems pertaining to the servicing of household refrigerators and small commercial refrigerating equipment as well as oil burners to "The Question Box."

COMMENTS ON PREVIOUS QUESTIONS

QUESTION Box: Referring to Question 306 of the May issue on Model ASD12-Westinghouse, I have been servicing the Westinghouse exclusively for the past four years, and I was very much interested in the question. The Model ASD12 has a small resistor mounted in the control box. When the main contacts are closed, current flows through service cable to control box, then to main contacts and starting relay to the starting winding on motor through the unloader coil. This opens the unloader valve, permitting motor to start with no load. This takes only a second.

The current passing through the starting relay coil decreases due to the resistance in the circuit, allowing relay armature to drop and opening contacts. This action decreases the current in the unloader coil and closes the unloader valve, at which time the motor is up to full speed.

The fan motor is a two-phase motor, operated from the main motor windings. The fan motor will not start until relay coil contacts are open and motor is up to full speed to generate two-phase energy.

This is a lengthy explanation but to find the trouble quickly it is very helpful to know how each part functions in the circuit. Some of the older General Electrics have a similar circuit with a resistor.

Yours Truly,
Lee Sunderhaus.

TROUBLE WITH VALVES FREEZING

QUESTION 314. I was called in on a job (Lipman) after an oil separator had been installed. It is on a hardening cabinet for ice cream, temperature 12 degrees below zero, methyl chloride.

My trouble is moisture. I have used a one lb. drier (Activated Alumina) and have refilled it three times. The expansion valve is still freezing up. I put about a tea cup of anydrous alcohol in the system, and still it freezes up. It would be a big job to send it in to be dried out. Is there anything I can do besides having it baked out? I am sure there is no leak where it could be drawing in moisture. This expansion valve is laying on its side. Has that anything to do with the operation of the valve? I am going to use calcium chloride in the drier next. How long could I leave that on before changing it?

Another job I have been working on is a Frigidaire (sulphur). The expansion valve doesn't open up, but when I put a blow torch on it, it opens up. Now, I've heard it is possible to have a valve freeze up on a sulphur job. This valve is a Frigidaire valve, and it, too, is laying on its side. These are both thermostat expansion valves. The valve is in a display case. What is your suggestion?

ANSWER: I am inclined to believe that your trouble with these expansion valves is due to something else apart from moisture in the system.

I am led to believe this because it seems hardly possible to me that an expansion valve would continue to freeze up after all you have done to the Lipman system, and because if there is sufficient moisture in a sulphur dioxide system to freeze up the expansion valve, you would have experienced a stuck-up compressor before this time.

I am wondering if your trouble is not due to either a sluggish action of the valve, which may be caused by wear in its working parts, or to moisture entering externally into the convolutions of the bellows, where it may freeze and prevent the valve from opening. The fact that the valve in both cases is laying on its side would help this situation since the moisture then would have a greater tendency to get in the convolutions of the bellows, and hold it in a closed position.

As a suggestion, I believe that I would remove the bellows casing, and thoroughly dry it, and then see that the adjusting nut

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Newark, N. J.....T. W. Binder Co.
Newark, N. J.
....Melchior, Armstrong, Dessau Co.
New Orleans .....Enochs Sales Co.
New York
....Melchior, Armstrong, Dessau Co.
New York
....Paramount Electrical Supply Co.
Omaha .....United Supply Co.
Paterson, N. J...White & Shauger, Inc.
Philadelphia
....Melchior, Armstrong, Dessau Co.
Philadelphia..Victor Sales & Supply Co.
Pittsburgh
....Melchior, Armstrong, Dessau Co.
Pittsburgh .....William M. Orr, Co.
Plattsburg, N. Y.....Aird-Don Co.
Portland, Ore.
Refrigerating & Power Specialties Co.
Portland, Ore. Refrigerative Supply, Inc.
Providence, R. I.....Rhode Island
Supply & Engineering Co.
Raleigh, N. C.....Henry V. Dick & Co.
Richmond, Ind.....The Starr Co.
Rochester, N. Y.
....Melchior, Armstrong, Dessau Co.
Sacramento, Calif..Hinshaw Supply Co.
Saginaw, Mich.
.....J. George Fischer & Son, Inc.
San Antonio...United Refrigeration Co.
San Francisco
.....California Refrigerator Co.
San Francisco
.....Pacific Metals Company, Ltd.
San Francisco
Refrigerating & Power Specialties Co.
Scranton, Pa.
.....Central Service-Supply Co.
Seattle
Refrigerating & Power Specialties Co.
Seattle.....Refrigerative Supply, Inc.
South Bend, Ind. F. H. Langsenkamp Co.
Springfield, Mass.
....Melchior, Armstrong, Dessau Co.
Syracuse, N. Y.
.....Central Service-Supply Co.
Toronto, Ont., Canada.....Railway
& Engineering Specialties, Ltd.
Troy, N. Y.....Aird-Don Co.
Utica, N. Y.....Vaeth Electric Co.
Washington, D. C.
....Melchior, Armstrong, Dessau Co.
Wilkes-Barre, Pa....Radio Service Co.
Winnipeg, Man., Canada...Railway
& Engineering Specialties, Ltd.

New additions to this list are being made daily

HIGHSIDE CHEMICALS COMPANY

Newark, New Jersey

packing and the bellows casing are tight so that no more moisture may enter.

Personally, I am not in favor of the idea of putting anhydrous alcohol in a methyl chloride system. While it may not do any immediate harm and in most cases will prevent freezing of the expansion valve when it is due to moisture in the system, the alcohol may cause corrosion at a later date. I believe it would be a good idea in the methyl chloride system you have in question, if you would blow out all the refrigerant and oil in it, and recharge with a fresh supply.

APEX REFRIGERATOR

Question 315. Recently we had a service call on a two-compartment Apex refrigerator, about six months old. This machine has been functioning efficiently, maintaining, according to the owner, a temperature of about ten degrees in the freezing compartment, and a satisfactory temperature in the warm compartment. Lately he complains that the temperature in the frozen compartment has gone up to twenty-six degrees and the temperature in the warm compartment is fifty degrees.

On checking the operation of the condensing unit, we find the machine is operating with a two-pound expansion valve setting, and the compressor valves hold satisfactorily. The doors on both compartments fit tightly, and there is no sign of leakage of any kind into the refrigerator. The head pressure shows sufficient Freon and the machine cycles satisfactorily. The running time is approximately the same as it has been before. However, in the morning upon starting, the customer claims there is a slight knock due, I imagine, to oil. This has also showed up just recently. The only thing we could find which might cause this trouble was that the temperature in the house falls down to about fifty degrees overnight because there is no heat.

Would this cold temperature in the room affect the temperature in the freezing compartment to this great extent? When servicing it, I set the cold control colder in order to bring the cabinet temperature down to about forty-four degrees.

I would appreciate any suggestions or information that you could give me in regard to servicing this type of refrigerator. We would like to be prepared in case we have a number of similar complaints, as there are a considerable number of these machines in homes where there is no heat during the night.

Answer: The trouble you are experiencing with the two-compartment Apex Refrigerator, in my opinion, is due to the low temperature of the room during the night time.

The temperature of these refrigerators is controlled by the temperature of the evaporator in the upper compartment, and when the outside temperature falls below 60°, the machine does not run often enough or long enough to maintain the proper temperature in the freezing compartment.

The Apex people caution against installing these refrigerators in a room where the temperature may fall below 60°. Perhaps setting the thermostat to a colder position will temporarily overcome this trouble. However, there is a possibility in doing this that you will experience frosting on the return line.

I believe it will be much better if arrangements can be made to locate the refrigerator in such a place where the temperature will not drop to such a low level overnight. Otherwise, it may be necessary to install a heating element in the compressor so that the refrigerant will not condense in the oil during the off-periods.

There is a possibility, under your present conditions, that the compressor will pump sufficient oil during the night to entirely drain it, and you will have difficulty due to burned-out bearings.

RESULT OF MIXING GASES

Question 316. (1) What dangers and inconveniences can be caused by adding, by mistake, methyl chloride (CH_3Cl) to a Freon (F-12) plant?

(2) How does SO_2 influence F-12 and CH_3Cl, when it comes into contact with one of these cooling mediums?

(3) Is it possible, when testing CH_3Cl and F-12 plants for leakage, to charge the plant with SO_2 and test it by means of NH_3, and then charge the plant with the cooling medium desired after emptying it of SO_2? What will be the consequences of this proceeding?

Answer: Your questions were referred to Mr. E. W. McGovern, of the R. & H. Chemicals Dept., E. I. duPont de Nemours & Co., and the following are the answers he has given:

(1) The addition of methyl chloride to Freon-12 would form a refrigerant mixture of slightly lower pressure characteristics and, therefore, slight adjustments to pressure-operated controls might be necessary. The liquid refrigerant mixture would be of

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(Read the article in the June issue of this journal—page 14 —Servicing the Frigidaire Hermetic Unit.)

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ATLANTIC CITY, N. J. . . . Atlantic City Auto Supply Co., Inc. . . . 3813-17 Atlantic Ave.
BALTIMORE . . . Melchior, Armstrong, Dessau Co. . . . 601 West North Ave.
BALTIMORE . . . Parks & Hull Appliance Corporation . . . 1034 Cathedral St.
BROOKLYN . . . Melchior, Armstrong, Dessau Co. . . . 1104 Bedford Ave.
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LOS ANGELES . . . Refrigeration Service, Inc. . . . 3109 Beverly Blvd.
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OMAHA . . . United Supply Co. . . . 207 N. 16th St.
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RICHMOND, VA. . . . Refrigeration Supply Co. . . . 1647 W. Broad St.
ROCHESTER, N. Y. . . . Melchior, Armstrong, Dessau Co. . . . 85 Franklin St.
SACRAMENTO, CAL. . . . Hinshaw Supply Co. . . . 1316 Jay St.
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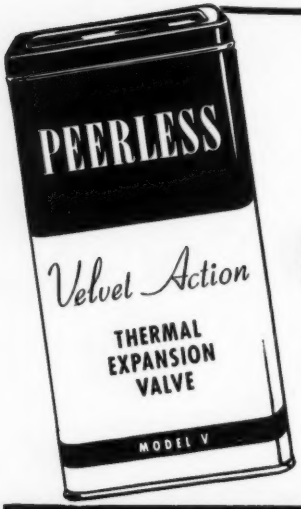

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lower specific gravity than of pure Freon-12, and, therefore, in machines equipped with float valves the latter would have to be properly adjusted if considerable methyl chloride were added. A methyl chloride mixture would be of higher toxicity than Freon-12 alone, and a mixture containing a high percentage of methyl chloride would be flammable.

(2) Sulpur dioxide has no chemical action on methyl chloride and Freon-12 under conditions existing in refrigerating systems. The sulphur dioxide mixture would, of course, be irritant, very corrosive in the presence of water, and would have different pressure temperature characteristics. The sulphur dioxide mixture would have a different density and a machine using it would have a lower capacity because of the larger volume of gas to be pumped.

(3) Refrigerating systems have been tested for leaks by this method. We have never recommended the test as a general procedure as it requires considerable work and may result in severe corrosion if sulphur dioxide is allowed to remain in a wet system for any length of time before a suitable dryer can be installed. However, if the test is to be used it should be made with the system free of lubricating oil and then the system should be carefully flushed free of sulphur dioxide before putting in the new refrigerant and oil charge.

GRAYBAR REFRIGERATOR

QUESTION 317. The other day I ran into a box sold by Graybar and manufactured by the Ilg Electric Ventilating Co., Chicago, Ill. The name plate data is:

Model RCU4A, Serial No. 4356

The only shut-off valves it has are the ones on the liquid receiver; one where the condenser empties into the liquid receiver, and a valve where the liquid line leaves the liquid receiver. There aren't any service valves on the compressor. There is a compound gauge at the very bottom of the compressor.

How do you service such a unit? Others have looked at it and refused to work on it. What is the chemical name of the gas used in it? I cannot find such a chemical formula. The trouble as far as I have found is in the cold control. It allows the refrigerator to run too long and everything freezes on the

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shelves. What should the setting of this control be?

Where can I get replacement parts for this refrigerator?

ANSWER: The Graybar refrigerator is a reciprocating-type compressor, charged with ten ounces of Isobutane, and the oil charge is 1¼ pints.

The method of servicing these units was to exchange receivers when a new charge of gas was necessary, the new receiver of course containing a full charge of Isobutane. In doing this, it was necessary to entirely pump the system down, disconnect the old receiver, then replace with a new one. The connection at the compressor head was then cracked, and the system evacuated, allowing the air to be discharged at the cracked connection at the compressor head. Air was purged from the condenser from the receiver through this same cracked connection.

Any service to be done on any other part of the system where it necessitates opening the system is done in the same manner, or in other words, by pumping down the entire system and holding the gas in the receiver while the work is being done. The control setting on these units would not be any different from those of similar type evaporators.

Parts may be purchased from the Ilg Electric Ventilating Co., 2850 N. Pulaski Rd., Chicago.

* * *

SOLDERING EVAPORATORS

QUESTION 318. I am servicing a Norge flooded evaporator which has a leak and I have tried to solder the hole without success, because of the fact that the tubing is round and the solder slips off. I have heard it would be best to do what is known as "wiping a joint" but I do not know how this is done and wish you would enlighten me on this subject.

I have also heard that solder should never be used in patching up leaks in a system using SO_2 or any other refrigerant but as I don't know if this is true I would like to know if you would confirm the idea. I know that solder is used for sweat soldering on larger installations and it seems to me that if the refrigerant would have any corrosive action on the joint it would not be used. I hope you will set me correct on this subject.

ANSWER: I am of the opinion that you are not getting sufficient heat in the evaporator to make the solder stick. Possibly you are trying to do this job with a soldering iron. If so, I don't believe you will have very much success, due to the fact that the iron would have to be much too large to be easily handled.

This work can best be done with a torch, applying heat directly to the location to be soldered. The flux should be brushed on immediately the evaporator is warm, so that the flux will flow evenly over the repair. Heat then should be added until upon applying solder to the evaporator, the solder will immediately melt, due to the heat in the evaporator, rather than to any heat applied to the solder direct. In this way, you get an even flow of solder, and if the surface has been properly cleaned, you will experience no difficulty in getting it to stick.

I don't know of any of the lower pressure gases that will affect solder, but as a usual thing, solders used on evaporators must have a small percentage of antimony and a fairly high percentage of tin. Solders which do not have these ingredients have a tendency to flake after a few months' use, due to an electrolysis evidently set up by the moisture and acids which continually come in contact with it. Any of the solders obtained from your local jobber will be satisfactory for refrigeration work.

CLEANING RECEIVERS. DRYING COMPRESSORS. ICE IN A SYSTEM

QUESTION 319. I have had considerable trouble with scale in a number of sulphur dioxide machines. I have taken the liquid receivers off and cut them open, cleaned them out and had them welded together again. Of course, I could have put on new ones, but some of the large water-cooled receivers run into a lot of money. If you have knowledge of some method of getting that scale out of there, I'd appreciate it very much if you would tell me about it.

If I wanted to dry out a compressor in the shop after having the condensing unit apart, would putting on a large dryer and running the machine for twenty-four hours without heating the unit dry it out satisfactorily, providing the room were at least 72° F.?

What happens to the ice in a valve after a dryer has been installed in a system? I

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have reference to these low temperature fixtures. In a sharp freeze room 10° below zero we have ice which does not mix with the refrigerant. Does the dry gas wear away the ice? Should the valve be thawed out a number of times?

ANSWER: I am not quite sure whether you are referring to a carbon scale in the liquid receivers of sulphur dioxide machines, or whether you are concerned with a lime scale in the water coil.

For removing carbon scale, I believe the most effective manner is boiling out the receiver in a strong Oakite solution, and if the carbon does not loosen up readily by this means, putting about two handfuls of small screws or particles of metal in, and shaking the receiver well will usually loosen it up.

For removing lime scale, it is probably necessary to use a stronger solution, such as muriatic acid or other acids which will dissolve the lime.

I don't believe that drying out a compressor in the manner you have mentioned will have much effect. The moisture in the system, if any, will be held in the oil and in the pores of the metal to some extent. There is no assurance that a drier will remove this.

When a unit is placed under a vacuum, the boiling point of water contained in it is reduced considerably, and by heating the unit in addition to this, we are reasonably sure that all moisture will be converted to vapor and is more easily removed by the suction of your vacuum pump. I don't believe that any other method can be expected to do as satisfactory a job.

If there is ice formation in a refrigerating system when the drier is installed, it will, in all probability, remain there until for some reason, it is allowed to warm up to the melting point and again circulates with the gas. This explains the reason why a system will occasionally operate satisfactorily for perhaps a year, and then suddenly freeze up the expansion valve with moisture. The moisture has been in the system during this time, but has been held as particles of ice in the evaporator, where it would do no harm, but for some reason, the ice particles have reached the point where they have again been converted to water, and have circulated with the gas.

Thawing out the expansion valve when installing a drier is a good practice, but it still does not assure you that the ice will be removed from the evaporator.

REFRIGERATION SERVICE ENGINEERS' SOCIETY

Official Announcements of the activities of the National Society and Local Chapters appear in this department as well as articles pertaining to the educational work of the Society.

On to Chicago

6th Annual R.S.E.S. Convention

IT is none too early to plan your Chicago convention trip. While you are now in the midst of an active refrigeration season—with twenty-four hours service expected—contemplate your Chicago trip in January.

Plans for the R. S. E. S. Convention will be perfected by an all-society convention committee. Educational and instructive in its make-up, it will provide, among other things, an opportunity of viewing the largest exhibition of refrigeration equipment, accessories, supplies and services ever segregated under one roof. In itself, this exposition represents a liberal education in the new developments and applications which are of particular interest to every member of the society.

The Refrigeration Equipment Manufacturers' Association in inviting the participation of equipment manufacturers stresses the theme that the industry will be on "Dress Parade" January 15 to 18 in Chicago at the famous Stevens Hotel—largest in the world.

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View of Michigan Blvd. with Stevens Hotel in foreground where refrigeration exposition will be held.

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● *ANSUL ICE-X dissolves ice and prevents ice formation. Non-corrosive, it contains no methyl or ethyl alcohol, no alkali, acid or other corrosives. It leaves no residue, does not react with refrigerants or oils. It may be used with acrolein methyl chloride.*

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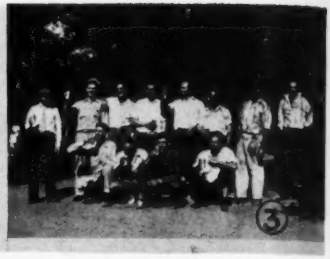


(1) The handsome couple are Mr. and Mrs. Mac Rorie of the B & B Refrigeration Service. (2) W. H. McDowell pictured with his truck, is with the West Coast Gas Engine Co. His only regret about the picnic is that he was unable to get any pictures of the baseball game played by the Engineers and their wives. What a game! "They couldn't win for losing," says Mac. (3) We don't know what these boys have in their hands, but we bet it is beer. (4) The kind of a gang it takes to make a picnic.

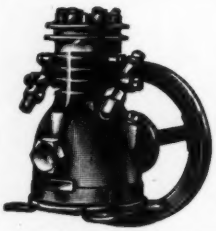
IT'S ALWAYS FAIR WEATHER WHEN GOOD FELLOWS GET TOGETHER

Of course fair weather is something they always have plenty of in San Diego so arranging a picnic merely meant loading the family and the lunch in the car and starting out. The first annual picnic of the San Diego chapter was held in El Monte Park, Sunday, June 11.

MILE HIGH CHAPTER BOWLING TEAM

AS a part of its activities during the past season, Mile High Chapter sponsored a bowling team made up of members of the chapter and entered it in the Capitol League.

The team distinguished itself by winning



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TECUMSEH PRODUCTS CO., Refrigeration Division TECUMSEH, MICH.

MILE HIGH CHAPTER BOWLING TEAM
Upper—The team in action.
Lower left—The emblem used as identification of the team.
Lower right—Tom Alexander about to take off.

first place in that league and the chapter was doubly repaid by the favorable publicity received and by the addition of the cash awards to the treasury.

There were four teams competing in the league and a total of 90 games were played. The Refrigeration Service Engineers won 48 games or 19 series with a score of 961.

Members of the team were E. L. Huff, Johnny Lind, T. C. Montgomery, Tom Alexander and Ernest Martin. Mr. Huff scored the highest game of 230 while Mr. Montgomery received the lowest score of 70. Tom Alexander proved that having only one arm is no handicap to him by bowling a consistently good game. He has the distinction of being the only one-armed service engineer in the country, and a good one too.

Members of the team all wore blue shirts and yellow ties. On the back of each shirt was embroidered the emblem of the Society which not only provided a distinctive identification but supplied the chapter with much beneficial publicity.

Mrs. Lind attended every game and served in the capacity of score keeper. Because of the moral support and encouragement she so generously gave where and when it was needed, she is given a large slice of the credit by the team for their success.

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Buffalo, New York—Root, Neal & Co.
Chicago, Ill.—Auto. Heat'g & Cool'g Sup. Co.
Cleveland, O.—Refrigeration Sup. Distributor
Columbus, Ohio—Refrig. Electric Supply Co.
Dallas, Texas—The Electromotive Corp.
Davenport, Iowa—Republic Electric Co.
Denver, Colo.—Ref'n Parts & Supply Co.
Des Moines, Iowa—Dennis Refrig. Supply
Detroit, Michigan—J. M. Oberc, Inc.
Evanston, Ill.—Auto. Heat'g & Cool'g Sup. Co.
Greensboro, N. C.—Hasco, Inc.
Indianapolis, Ind.—F. H. Langsenkamp Co.
Jacksonville, Fla.—Bowen Refrig. Sup., Inc.
Kansas City, Mo.—Forslund Pump & Mach. Co.
Lincoln, Neb.—Ruegg Refrigeration Supply
Los Angeles, Cal.—Elec. App. Service Corp.
Louisville, Ky.—Geo. Dehler Jr. & Co.
Maywood, Ill.—Auto. Heat'g & Cool'g Sup. Co.
Memphis, Tenn.—United Refrig. Supply Co.
Miami, Fla.—Berner-Pease, Inc.
Milwaukee, Wisc.—Thermal Co., Inc.
Minneapolis, Minn.—Vincent Brass & Copper, Inc.
Nashville, Tenn.—Starr Company
Newark, N. J.—T. W. Binder Co.
New Orleans, La.—Enochs Sales Co.
New York, N. Y.—Paramount Elec. Supply Co.
Oklahoma City, Okla.—Macklanburg Brass & Copper Prod.
Omaha, Nebraska—United Supply Co.
Philadelphia, Pa.—Victor Sales Corp.
Pittsburgh, Pa.—Joseph Woodwell Co.
Portland, Me.—Ballard Oil & Equip. Co. of Me.
Richmond, Va.—Refrigeration Supply Co.
St. Louis, Mo.—Brass & Copper Sales Co.
St. Paul, Minn.—Thermal Co., Inc.
San Francisco, Cal.—Cal. Refrigerator Co.
San Francisco, Cal.—Cyclops Iron Works
Schenectady, N. Y.—Murray Sales Co.
Scranton, Penna.—Central Service Supply Co.
South Bend, Ind.—F. H. Langsenkamp Co.
Springfield, Ill.—Springfield Refrig. Supply
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Aminco No. 614 Water Valves now operate in water pressure up to 200 lbs. per square inch and shut off tightly with no chatter. Removable seat can be replaced with an Allen wrench without disturbing valve or lines.

These features have been proven as to performance for several years on high pressures and hard water applications and are now standard on Aminco No. 614 Water Valves. One valve for all refrigerants and water conditions at new low prices.

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Manufacturers of
Aminco Refrigeration Specialties including Expansion Valves, Water Valves, Snap Action Valves, Oil Separators, Dehydrators, High Side (Replacement) Floats, Two Temperature Valves, Throttling Valves, etc.

1481 14th Ave., Detroit, Mich.

Chapter Notes

Under this heading will appear news of the chapter meetings. For names of the officers and dates of regular meeting nights, please refer to the Chapter Directory.

TWIN CITIES CHAPTER

June 13th—The meeting was called to order by President William V. Warner and the first discussion of the evening pertained to ways and means of improving the attendance for future meetings.

President Warner stated that cards had been sent out to the membership requesting a statement from them regarding their desires to hold meetings during July and August.

A committee, consisting of the President and any additional members he wishes to appoint was provided for the specific purpose of stimulating interest in future meetings.

LOS ANGELES CHAPTER

June 2nd—An interesting moving picture of frozen foods and fruit juices was shown

You should find out about THIS THERMOMETER

● You should find out how this recording thermometer helps you locate trouble, check temperatures, forestall call-back complaints. *Write today for the FREE Practical Instrument Bulletin.*

RELIABLE AND CONVENIENT: This recording thermometer gives you 24 hour records of temperature. Eight years of use in the refrigeration industry have proved its reliability. Thousands are now used for all kinds of test work. The Practical thermometer is as easy to use as an alarm clock. The pen mechanism is entirely contained in the door and swings out of the way when you open the door to change the chart. The chart is held without pins or other loose parts. These reliability features are exclusive with Practical instruments. *Write for complete information, including terms, specifications, guarantee, and 15-Day Trial Offer. All explained in the Free Practical Bulletin. Write for it today! Practical Instrument Co., Dept. G, 2717 N. Ashland, Chicago.*

Recording Thermometer $18 with metal carrying case.

USE PRACTICAL INSTRUMENTS
BUY FROM YOUR SUPPLIER

by Mr. Regis Gubster of the California Consumers Corporation. Mr. Gubster also showed an interesting picture of a ski jump held in the Los Angeles Coliseum.

The business meeting of the evening was then called to order and the minutes of the previous meeting read.

Proposed amendments of the chapter By-Laws were voted upon and passed unanimously.

LONG BEACH CHAPTER

June 1st—Mr. Robert Allen, city refrigeration inspector, gave an interesting talk at the opening of the meeting, following which Mr. A. L. Pregler introduced Mr. Irwin, who in turn spoke briefly on health and accident group insurance policies.

Some discussion led to the adoption of the policy of presenting the retiring President and Treasurer with an R.S.E.S. lapel button.

The balance of the evening was devoted to the election of officers, with the following results: *President,* H. F. Voepel; *1st Vice President,* J. H. Engel; *2nd Vice President,* A. T. Riley; *Secretary,* I. Hammer; *Treasurer,* Roy Willis; *Sergeant-at-arms,* L. S. Gould; *Educational Chairman,* Everett Brown.

PITTSBURGH CHAPTER

June 9th—A discussion of service problems was led by Mr. E. V. Black with many problems discussed and much useful information being derived from same.

Mr. Black announced the cancellation of the July and August meetings due to the rush of work at this time.

The Entertainment Committee was authorized to make complete arrangements for the picnic to be held during the third week of July.

MILE HIGH CHAPTER

June 14th—In reporting for the Picnic Committee Mr. A. C. Darby stated that all arrangements had been completed for the picnic to be held June 25th at Filius Park. The program, which Mr. Darby read, was very interesting and gave promise of a lively picnic. Notices of the picnic were to be mailed on June 15th.

A report of the activities of the bowling team was made by Tom Alexander and after some discussion it was decided to enter the team in the next tournament and also to arrange for a second team. Messrs. J.

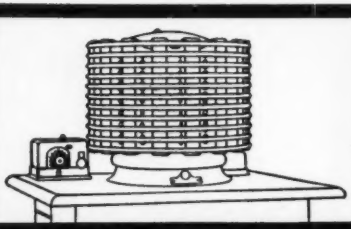
NOW'S THE TIME!

Refrigerator thermostats turn into regular slave drivers in hot weather, and they sure take it out on motors and compressors. A really good hot spell is likely to come along and plenty of old (and some not so old) units will need a good going over.

To give the best service on these jobs and build real customer satisfaction, here's a hot weather tip that's good year round. Now's the time to stock up with quality refrigerants, parts and supplies—you'll find them at your nearby "Virginia" jobber.

VIRGINIA SMELTING COMPANY

W. NORFOLK, VA.



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7701 Avalon Ave., Chicago, Ill.

O'Connell, F. DeCresentis, L. Martin, F. O'Connell, P. Bowman, W. Bowman and A. Huter expressed a desire to join this second team.

It was decided that meetings of the chapter be discontinued until some time in September.

The balance of the evening was devoted to a quiz contest, the questions for which were supplied by the National Society.

Refreshments were served following the meeting.

SCRANTON CHAPTER

May 16th—The guests of the evening were Mr. Van Kreiken and Mr. Van Horn representing the Minneapolis-Honeywell Regulator Co., who gave an interesting talk illustrated by pictures of controls in general and their new Polartron system in particular. Their novel way of constructing a control by pictures was well received.

June 6th—Mr. E. Kellie of the American Injector Co. was a guest of the evening and demonstrated the use of their various products. His talk proved both educational and entertaining.

ST. LOUIS CHAPTER

May 25th—Mr. E. Gygax introduced Mr. H. F. Spoehrer of the Spoehrer-Lange Co., manufacturers of the Sporlan line of liquid control valves, who gave a most comprehensive story, illustrated by lantern slides, of their complete line. He was assisted at the projector by Mr. W. F. Wischmeyer. A period of questions and answers followed the talk, which brought out many additional points of interest.

A brief recess was called to permit inspection of the samples on display, after which the business session of the evening began.

A short explanation regarding the change in the time and place of the forthcoming national convention was made by President A. Huhn and Secretary E. A. Plesskott.

MISSISSIPPI VALLEY CHAPTER

June 9th—The meeting was called to order by President L. Nelson, and the minutes of the previous meeting read.

The President then read a letter to the members which had been received from Mr. E. L. Bengston, submitting his resignation as Secretary of the chapter. The resigna-

tion was accepted by the chapter and the President was asked to appoint another Secretary to fill Mr. Bengston's place.

Mr. Nelson then took a number of questions from a refrigeration manual which he had brought for the purpose and called for a general discussion of these questions from the floor. Much useful and helpful information was derived from these discussions and Mr. Teagarden and Mr. Sackey were called upon to explain the different types of refrigeration equipment.

A picnic is being planned for the near future and Mr. J. Sackey was appointed to assist Mr. D. S. Brainard, chairman of the Entertainment Committee, in the arrangements.

AKRON CHAPTER

May—The regular meeting of the month was very well attended by more than sixty-five members and visitors from seven surrounding cities within a radius of 50 miles of Akron.

The Detroit Lubricator Co., represented by Mr. T. McKee, presented a sound film covering the operation of the expansion valves and controls manufactured by his company. A Dutch lunch followed the meeting and it was unanimously felt that an interesting and educational meeting had been spent.

ROCKFORD CHAPTER

May 15th—The attendance prize for this meeting was drawn by Mr. D. VanDenberg.

After this regular event, the minutes of the previous meeting were read by the Secretary. Some discussion followed regarding the prospective banquet to be held on the 5th of June for the benefit of members and prospective members. The Secretary was charged with the duty of securing a place for the holding of the banquet and a committee was appointed for the purpose of completing the arrangements.

Mr. Fred Barney, chairman of the Educational Committee introduced Mr. D. VanDenberg of the VanDenberg Supply Co., who proceeded to give an interesting talk and demonstration of the Syntron seals.

Refreshments were served following the meeting.

June 5th—The banquet was held in honor of the new members of the chapter. The meeting was a very successful one and enjoyed by everyone.

Mr. Willis Stafford and Mr. E. H. White

Start that Motor in a Jiffy!

● Where refrigerator breakdowns are due to wornout or abused capacitors, servicing is easy. ★ Just use AEROVOX *Emergency Capacitors* for any capacitor-type motor—17½ to 152½ mfd.—simply by plugging in corresponding leads to make up correct capacity. Replace later, at your convenience, with standard replacement. ★ And to ascertain correct and safe capacity in absence of other data, use the AEROVOX *Capacitor Selector*. A simple, positive, quick way of getting refrigerators going. ★ Ask local jobber for details. Or write direct for descriptive folder.

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Used in Dehydrators by leading manufacturers and furnished to the Service Engineer by leading Supply Dealers.

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YELLOW SPRINGS, OHIO

were visitors at the banquet and Mr. Stafford gave an explanation of the Society, citing several concrete examples of its help and usefulness to the independent service engineer.

Mr. E. H. White, who is Secretary of the Illinois State Association, informed the members of the Rockford Chapter that the State Association had come to the decision of holding its 1939 state convention in Rockford. President McCarthy, in accepting the decision, stated the Rockford Chapter would do everything possible to make the convention a success.

Mr. Hunt, manager of the Nelson Hotel, who was also in attendance, pledged the support and cooperation of the hotel.

CAPITAL CITY CHAPTER

May 3rd—An unusually large group of members and non-members was present at this meeting. After opening the meeting, the chairman gave a short talk on the benefits to be derived from membership in the chapter, and then turned the meeting over to Mr. N. E. Burdette, chairman of the Educational Committee.

Mr. Burdette introduced Mr. F. S. Bartlett of the Detroit Lubricator Co. Mr. Bartlett gave an interesting talk on Detroit products and then introduced Mr. Roy Stevens of the same company, who presented a sound film portraying Detroit products. Following the showing of the entire picture, flash-backs were shown and a more extensive explanation given of each part. A question and answer period was answered by Mr. Stevens, and proved to be equally interesting.

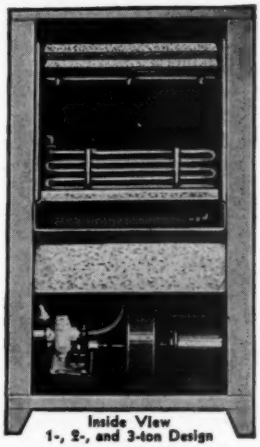
After the gratitude of the officers and members had been expressed to the representatives of the Detroit Lubricator Co., refreshments were served and the meeting adjourned.

DAYTON CHAPTER

June 23rd—The meeting was called to order by President R. J. Brown and after the business of the evening had been dispensed with Mr. Brown and Mr. Shoupp presented three reels of a moving picture which was taken at the national convention in Buffalo last November. This was followed by another movie by the same gentlemen which had been taken during a recent fishing trip in Northern Michigan. While

Cut Power and Water Costs

MARLO
Evaporative Condenser



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For greatest operating economy investigate these outstanding Marlo features:

1. Generous condensing surface.
2. Complete corrosion resistance; all inside surfaces asphalted over galvanizing.
3. Positive water circulation; water outlets provided from pump for compressor head.
4. Weight; generously proportioned heavy gauge frame and housing. Larger sizes are sectional, promoting easy installation.
5. Smallest practical floor space consistent with high performance.
6. Quiet; designed to operate with minimum vibration and sound.

Write for Special Bulletin No. 394

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Canada and British Isles: Universal Cooler Co., Brantford, Ontario

Manufacturers of Complete Line of Low Side Equipment X-3R2

the pictures did not pertain to refrigeration, they proved very entertaining and were much enjoyed by the membership.

KANSAS CITY CHAPTER

May 9th—The evening got under way with a talk by Mr. S. A. Leitner on the advantages of membership in the R.S.E.S.

Mr. Charles Anderson of the Imperial Brass Mfg. Co., was next introduced and gave a comprehensive outline of Imperial products, after which he proceeded with arrangements for the tube bending contest which followed.

The contest was won by Mr. E. J. Storm of the Pony Express Chapter at St. Joseph, Missouri. Mr. J. P. DeWilde, president of Kansas City Chapter was second, and Mr. Richard Meeker was third. A total of seven contestants entered the contest and exceptionally good time was made by all. The judges of the contest were Mr. M. M. Rivard of the Detroit Lubricator Co., Mr. E. Mertz of the Diesel Air Conditioning School and Mr. Pehl, a consulting engineer; Mr. W. L. Davidson of the Refrigeration Equipment Co. was the timekeeper.

The lady visitors were interested spectators of the event.

May 23rd—Mr. Andrews, in reporting the recent Auxiliary dinner dance and card party held on May 6th, stated that it was a grand success. At the same time Mr. Andrews announced there would be a picnic held jointly by the chapter and the Ladies' Auxiliary on June 4th.

Two new members were admitted at this time, and President J. P. DeWilde administered the obligation for new members and extended the welcome of the chapter to them.

It was announced that educational programs during the summer months would be dependent entirely upon chapter members for speakers, and after some discussion it was decided that only one meeting a month would be held during the summer months.

On the educational program for the evening Mr. Andrews presented Mr. R. Meeker who gave an interesting talk on the Westinghouse refrigerator and with the aid of a blackboard tore down and rebuilt a Westinghouse refrigerator. Mr. Meeker's talk convinced the members in general that there is plenty of talent among them if he is to be taken as a representative of the chapter.

June 13th—Several new members were admitted to membership at this meeting and received the obligation of the Society.

The completed price list for members was presented by Mr. F. A. Thompson and passed out to those present.

Mr. Andrews, in reporting on the picnic held June 4th stated it was a grand success.

Discussions followed on the prices of various service companies throughout the city, which brought to light many interesting points.

On the educational program for the evening, Mr. C. B. Scofield was introduced and gave a talk on refrigeration and its history.

TRI-COUNTY CHAPTER

May 5th—The educational program consisted of a talk by Mr. Harold Anderson on the bellows type expansion valve who demonstrated his points with prepared charts showing the difference in super heat between the bellows and diaphragm types. A discussion on the subject was led by Mr. W. Stafford.

An Educational Committee was appointed by Mr. Metcalf consisting of Messrs. C. Stumpf of Elgin, Harold Anderson of Joliet and Willis Stafford of Aurora.

May 19th—A complete report of the dance held in Elgin on April 22nd was given and Mr. Clarence Stumpf was appointed to settle all bills, etc., accruing from the arrangements.

The meeting was then turned over to three representatives of Refrigeration Appliances, Inc., of Chicago, who gave an interesting talk on the use of blower coils for all types of refrigeration.

REPORT FROM CENTRAL INDIANA

WE thought it would be a fine idea to make a personal visit on all the service men, members and non-members, and invite them to meet with us in our shop June 6 and bring their service troubles with them.

At Montpelier, Indiana, we found George Mahoney, who was working on an ice cream cabinet. We looked up Dewin Dalbuy and L. T. Zigler at Huntington, Indiana, and both boys were covered up with work. We encountered William McKinstry at Peru, Indiana, who has a service shop of his own,

This tool will eliminate makeshift devices for removing troublesome Norge seals, oil-thrower rings on Delco and other motors, and most sizes of Rotary seals when frozen on compressor shafts.

Constructed of cadmium plated steel, this tool is adjustable to all shaft lengths and can be adapted to a variety of uses other than those mentioned. *Ready for immediate delivery. If your jobber doesn't carry this handy tool, write to:*

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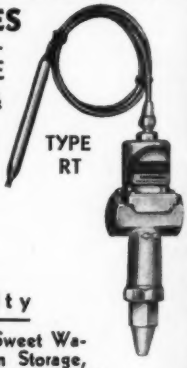

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Full ⅝" O. D. Line Capacity

For Unit Coolers, Sweet Water Baths, Ice Cream Storage, Milk Coolers, Multiple Jobs, etc.

Speed Wrench Adjustment

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and we looked up Art Carpenter who works for the Sanitary Milk Company. At Logansport we looked up one of our charter members, Mr. William Norwood, who was having some fun putting a capillary tube on a Crosley. We stopped at the Shaffer Electric in LaFontaine, Indiana, to find Mrs. Shaffer in charge of the store and Mr. Shaffer out servicing an electric range. We left an invitation for Mr. Shaffer to attend the meeting and to bring the range with him. At Fairmount we encountered Mr. William Hollenbeck, who was having troubles of his own with some beverage equipment. We soon left him to his own trouble. On our way through Marion we waved at Paul Jacobsen, who seemed to be in a large hurry. We surmised that he had received a call from Mrs. Jacobsen saying that the chickens were out again. (By the way, Paul, when will the chickens be large enough to fry?)

At Wabash Mr. William Sevy was so busy in his new shop that he did not have time to eat a sandwich with us. At Kokomo we looked up Herbert Hale who was busy answering the telephone. We encountered several service men at Anderson, all of them working overtime. At Muncie the same thing applied.

Becoming alarmed about everybody's business being so good, I hiked myself back to Marion to find my own telephone having the Jitterbug Swings.

By Tuesday night everything had calmed down, and the boys had the floor in the shop cleared for action. Mrs. Nold had strawberries and cake a foot high on the dining room table when the service men began to arrive with their compressors, motors, electric ranges, and what nots. About half of the men who were invited were able to come, but those who did come certainly made the strawberries and cake look sick. There is that telephone again, so we will be seeing you next month.

Vern Nold, Secretary.

KANSAS CITY LADIES' AUXILIARY

A MEETING was held on May 23rd and was called to order by Mrs. O. R. Irwin, president. A decision was made to hold only one meeting a month during the summer months—on the second Tuesday.

Mrs. T. L. Anderson, chairlady of the Entertainment and Educational Committees, took over the meeting. It was agreed by the

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Wrench & Tube Cutter Set

SET CONSISTS OF

1 6" RIDGID WRENCH	$0.61
1 8" RIDGID WRENCH	.70
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1 14" RIDGID WRENCH	1.23
1 18" RIDGID WRENCH	1.76
1 00 TUBE CUTTER	1.24
6 00 CUTTER WHEELS	.83

Total Regular Selling Price, $7.28

OUR SPECIAL LOW PRICE FOR COMPLETE SET $5.70

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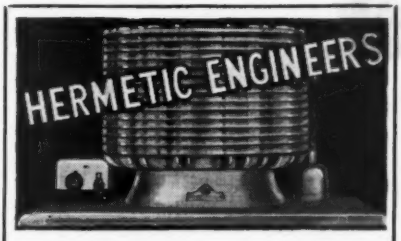

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members that when the regular semimonthly meetings are held one will be devoted to educational studies and the other to entertainment. The committee announced a special entertainment feature had been planned for the meeting of June 13th.

A study of parliamentary law is to be taken up in the near future.

As an attraction to get members to attend meetings, it was unanimously agreed to adopt "Bank Nights." $1.50 was taken out of the treasury to start this event, and Mrs. Hataway was the first winner. If the member whose name is drawn is not present, the amount is to be carried over for the next meeting and that member will be notified by postal card that her name was drawn. The drawings will be held once a month, the night to be decided each month by the committee.

GENERAL CONTROLS' NEW BRANCH OFFICE

GENERAL CONTROLS CO., Glendale, California, manufacturers of automatic temperature and flow controls, announces the establishment of a branch office at 3626 Wyoming St., Kansas City, Missouri.

Edmund V. Bialik, Sales Engineer, will be in charge of this office.

The opening of a direct factory branch in Kansas City by General Controls is in line with the company's policy of offering national sales and service on all their products through direct factory branches in principal cities.

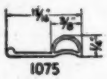
General Controls also maintains factory branch offices in New York, Chicago, Detroit, Cleveland, Houston and San Francisco.

F. E. JERNBERG NEW SALES MANAGER FOR MILLS

HAYDEN MILLS, secretary of Mills Novelty Company, Chicago, announces the appointment of Forrest E. Jernberg as sales manager of Mills Refrigeration Division, effective July 1.

Mr. Jernberg, affectionately known as "Jerry" to the trade, has been in the refrigeration business 12 years and is one of the best known men in dealer and manufacturing circles throughout the country.

Jarrow Replacement Door Gaskets



The gasket illustrated was made especially for SERVEL replacement. It fits. ALL JARROW gaskets are built to Manufacturers' specifications. INSIST on JARROW gaskets. Your nearest Jobber has them.

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Immediate Delivery on Replacement Parts for Electric Motors and Fans

Motor Parts . . . armatures . . . bearings . . . brushes . . . brush holders and springs . . . cent. switches . . . commutators . . . oil rings and cups . . . short circuitors . . . thrust washers.

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Always give complete name-plate reading or send sample. We will send catalog with your first order. Order on your business letterhead.

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WATER REGULATORS
AMMONIA VALVES
GAUGE SETS
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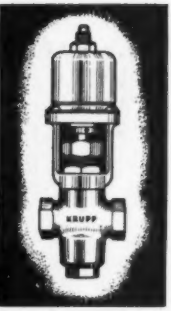
STRAINERS

are manufactured to meet today's requirements. Write for copy of our new catalog.



CYRUS SHANK COMPANY
625 W. JACKSON BLVD. CHICAGO, ILLINOIS

Mr. Jernberg had his own refrigeration business for five years and organized several distributor service organizations; has been with Mills Novelty Company for the past five years as central-west representative serving dealers and manufacturers.

F. E. JERNBERG

Jernberg expects to complete the current 1939 Mills year with a volume of compressor sales 50 percent ahead of last year.

MANUFACTURER'S FIN COIL CO. UNDER NEW MANAGEMENT

THE Manufacturer's Fin Coil Company of 2505 South Pulaski Road, Chicago, Illinois, has been purchased by William W. Bradfield and T. Walter Boydston.

Officers of the corporation are Mr. William W. Bradfield, President, Mr. T. Walter Boydston, Vice President and Treasurer, and Mr. George L. Tenney, Secretary.

They will continue to manufacture and market a complete line of refrigeration low sides for commercial applications.

Both Mr. Bradfield and Mr. Boydston were employed in executive capacities by Peerless of America, Inc., for a number of years.

* * *

NEW CATALOGS AND BULLETINS

FEDDERS MFG. CO., INC., Buffalo, N. Y., have just issued a new bulletin—No. 891—describing in detail their line of oil separators, high side floats and heat exchangers. Cross-sectional drawings are shown with each of these devices giving a clear picture of how each is constructed and how it performs its work.

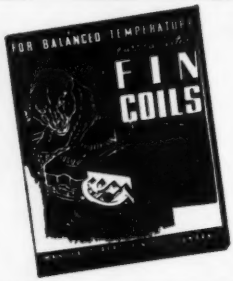
The bulletin is very informative and will

NO MUSS-NO FUSS

New SO_2 Leak Detector. Made from steel, cadmium plated. Contains felt wick, saturated with 26% ammonia. Keeps rest of your tools from rusting. Carry in your pocket or tool kit. No breakage like old way.

Price $1.00
See your jobber or send check to:

REFRIGERATION TOOL COMPANY
LIMA OHIO



"Purpose Tested" Fin Coils

"Purpose Tested" is all the name implies. Manufacturer's complete line of commercial refrigeration low sides provides a type and size for every application.

In addition to highest standards of manufacture—
—Coils are shipped within 24 hours of receipt of order
—A competent engineering department maintained to help you with your problems.

MANUFACTURERS FIN COIL COMPANY
2505-7 So. Pulaski Road CHICAGO, ILL.

be useful to the trade. Copies are available on request.

The Republic Electric Company of Davenport, Iowa, now has for distribution their new catalog on Refrigeration, Air Conditioning and Automatic Heating Supplies and equipment.

S S S

NEW CONTROL BOARD INSTALLED IN U.E.I. LAB.

A SPECIALLY designed board of air conditioning controls, reported to be the only one of its kind in existence, has just been placed in active use at the Chicago Laboratory of the Utilities Engineering Institute.

The control board combines control systems and devices of leading manufacturers into a central hook-up duplicating installations which might be found on any air conditioning system. Included in the arrangement are controls for installation outside of buildings connected to sub-controls inside the building regulating temperature changes.

Another part of the system includes controls for oil burners, stokers and gas heating equipment which are connected to electrical and pneumatic systems regulating dampers and valves.

The board panels are counterbalanced, movable and interchangeable, assuring easy access to all controls; ample space at the back of the board permits inspection of the wiring. Each panel has a separate connection to the power supply which may be turned on by a master switch. Control units are grouped to show typical control systems. Mounting, wiring and piping follows standard installation practice in-so-far as the panel board installation permits.

By use of heating elements, pressure lines and numerous pilot lights, actual operating conditions are closely simulated. A schematic diagram of each control group, indicating its location on the job, serves to point out the function of each. Colored cellophane ribbons trace the connections from one control to the other showing graphically the inter-relation of each.

Full use of these facilities is assured by requiring laboratory students to make extensive tests which acquaint them with each control system. Work on the panel also includes the diagnosis of trouble and its remedy.

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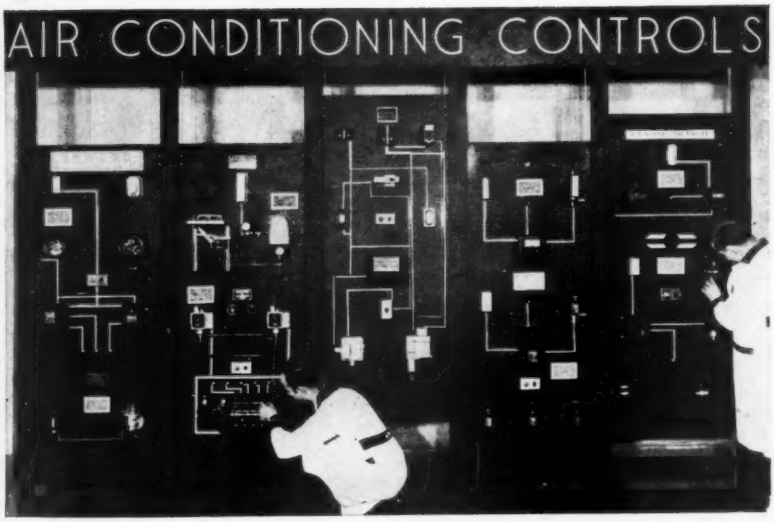

View of new control board installed in U.E.I. Laboratory. Note that panels may be raised or lowered as required. Entire board designed and installed by U.E.I. engineering staff.

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RAY POLLEY NOW WITH ANSUL

RAY POLLEY, one of the old timers in the refrigerating field, is now District Manager for Ansul in the southwestern territory, made up of Texas, Louisiana, Mississippi, Arkansas, Oklahoma and the western part of Tennessee.

Ray started his refrigeration work as a distribution organizer in 1923, when he had the job in California of placing a carload of "Superiors," manufactured by Frank Andrews. In December 1923, "Zerozone" came into existence and Ray installed the first machine, numbered 1201. As National Service Manager, Ray developed a service department that was the envy of other manufacturers. With a good product properly serviced, Ray had a record of twenty-six hundredths (.26) calls per machine per year during the year 1926. Modestly, Ansul might claim a share of this record, for "Zerozone" used only Ansul sulphur dioxide and the exceptional quality of the product even in those earlier days, was undoubtedly a contributing factor toward success.

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In 1933, Ray set up a remarkably efficient national service department for Mills Novelty. Composed of 600 contracted independent service men, this service organization was so well knit together through Ray's efforts and personality, that it is now almost like a fraternity, and Mills as a result, has superb installation, demonstration and servicing on its counter ice cream freezers throughout the country.

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PERSONNEL CHANGES AT FEDDERS

THE Fedders Manufacturing Company, Inc., of Buffalo, N. Y., announces the resignation of H. E. Rieckelman, former Vice-President in Charge of Sales of Re-

W. D. KEEFE

frigeration and Air Conditioning Products. His duties will be taken over by W. D. Keefe, who has been with the Company for the past 17 years.

BERGQUIST JOINS AIRO STAFF

KARL BERGQUIST, formerly manager of the refrigeration parts division of Borg-Warner has joined the staff of Airo Supply Company, according to an announcement from E. W. Scotten, store manager.

Mr. Bergquist has been active in the refrigeration parts business for a number of years starting with Borg-Warner at the time they established the refrigeration parts division.

PARTS TOOLS SUPPLIES
for refrigeration & air conditioning
Write on your letterhead for our 1939 catalog.
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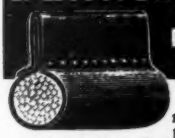
FOR ALL MAKES REFRIGERATOR DOORS



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In his new position Mr. Bergquist will contact servicemen in Chicago and vicinity for Airo Supply, and assist with other details under the direction of Manager Scotten.

REFRIGERATING SHASTA DAM

(Continued from page 20)

To accomplish this immense job of cooling, a total of about 1,140 miles of one-inch steel tubing will be imbedded in the concrete when it is being poured and will serve as the cooling coils of the refrigerating system. The coils will vary in length from three hundred to twelve hundred feet. A total of about 400,000 expansion type couplings will be required in making connections.

The coils all meet common headers and refrigerated water will be pumped through them with a velocity of not less than two feet per second. Cooling will be done in sections or lifts of about 50 ft. each and because the temperature of the water will vary with the depth, the temperature of the concrete will also have to vary with the different sections.

Temperatures of the concrete and individual coils will be taken through the use

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MEANS
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STOP LEAKS WITH
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UNTIL RELEASED BY HAND
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Will eliminate much of the guess work in service work—resulting in satisfied customers and bigger profits. *Send name and address for details of this training program.*
UTILITIES
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404 N. Wells St. Chicago, Ill.

of resistance thermometers and thermocouples imbedded in the concrete and inserted in the coils. Readings, however, will be taken after refrigeration has been stopped for 72 hours, which will provide sufficient time for the temperature to equalize throughout the individual areas.

The method of cooling the circulating water and the type refrigerating system used will be left entirely to the refrigerating contractor, but some idea of the magnitude of the cooling job to be done can be gained from Table 1 and the fact that there will be approximately five-and-one-half million cubic yards of concrete to be cooled, which will contain more than 250 billion B.t.u.s to be removed. The temperature of the concrete ranges upward to 129 degrees F. and must be cooled to as low as 48 degrees F.

TABLE I—ABUTMENT

Elevation	Quantities Cu.Yd.	Max. Temp. of Concrete	Required Temp. of Concrete	Average Heat to be Extracted	B.t.u. per cu.ft. to be Extracted
700 to 750 ft.	420,000	103°F.	48°F.	62°F.	57,400
900 to 950 ft.	670,000	95°F.	48° to 60°F.	32°F.	29,600
950 to 1000 ft.	540,000	90°F.	60°F.	37°F.	34,200
SPILLWAY SECTION					
900 to 950 ft.	85,000	124°F.	60°F.	61°F.	65,700
700 to 750 ft.	210,000	129°F.	48°F.	88°F.	81,400
600 to 650 ft.	250,000	106°F.	48°F.	65°F.	60,100

CANADIAN
Distributors for
Controls
Valves
Seals
TEXACO
Tubing — Fittings — Gaskets
AIRCO REFRIGERATION PARTS
708 Aqueduct St., Montreal, Quebec, Canada

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for all types of hermetically sealed units our specialty
Complete stock of rewound stators for G. E., Grunow, Majestic and other refrigerators for immediate replacement. *Write for prices.*
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Arco Wrought Copper Fittings *exclusively* are used in the refrigeration gas lines of the Carrier Air Conditioning installations aboard these ships.

Light in weight and space saving, they make a copper-to-copper connection that's stronger than the pipe itself; that can't leak; that's proof against vibration, strain and pressure.

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(Below) In foreground, two of the Moore-McCormack vessels in which Arco Wrought Copper *Fittings are used exclusively in the refrigeration gas lines.*

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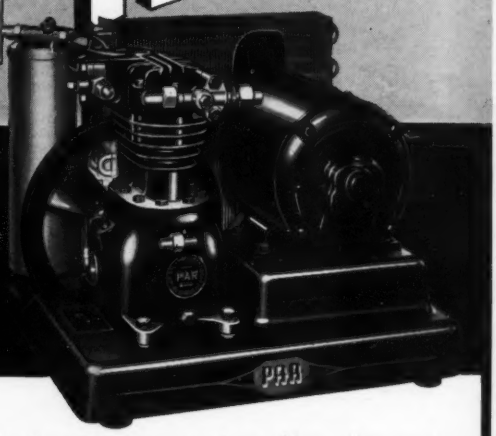

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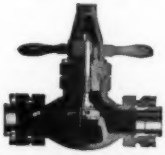

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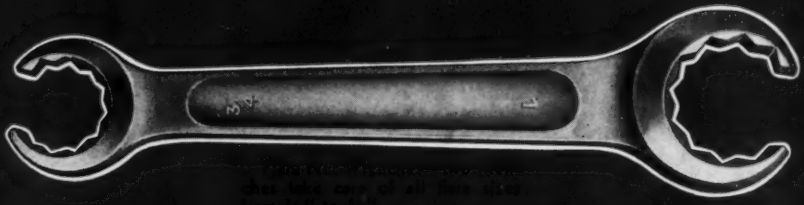
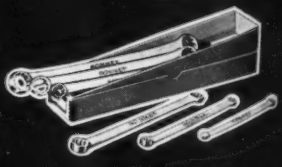


The Right Bonney Tool for Every Purpose



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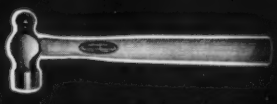

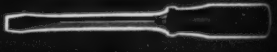

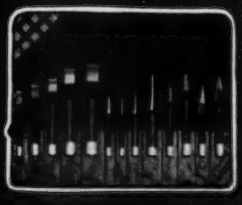

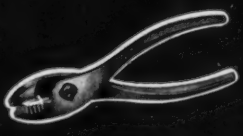

Bonney Forge & Tool Works, Allentown, Pa.